United States
Department of
Agriculture

Forest Service

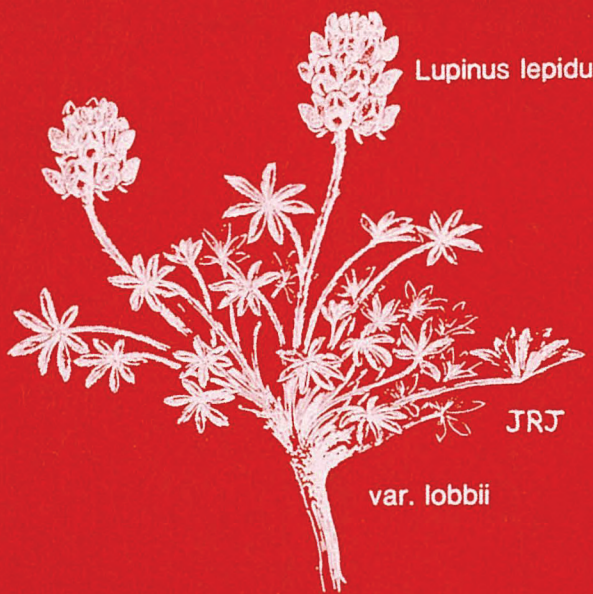
Intermountain
Region

R4-ECOL-99-01

1999

Eastern Sierra Nevada Riparian Field Guide

LIBRARY FORT COLLINS CENTER
Rocky Mountain Research Station
240 W. Prospect St.
Fort Collins, CO 80526



LIBRARY FILE COPY
Rocky Mountain Research Station

Eastern Sierra Nevada

Riparian Field Guide

Dave A. Weixelman
Desiderio C. Zamudio
Karen A. Zamudio

Humboldt - Toiyabe National Forest,
Ecology Team

Humboldt - Toiyabe National Forest
1200 Franklin Way
Sparks, NV 89431

photos by authors

The United States Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, gender, religion, age, disability, political beliefs, sexual orientation, and marital or familial status. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at 202-720-2600 (Voice and TDD).

To file a complaint of discrimination, write USDA, Director, Office of Civil Rights, Room 326-W, Whitten Building, 14th and Independence Avenue, SW, Washington, DC 20250-9410 or call 202-720-5964 (Voice or TDD). USDA is an equal opportunity provider and employer.

Publication Number 22.10.417. 07/99

THE AUTHORS

DAVE A. WEIXELMAN is a botanist working with the Humboldt-Toiyabe National Forest. He received a B.S. degree in botany and a M.S. degree in wildlife management from the University of Alaska, Fairbanks. Prior to working on the Humboldt - Toiyabe National Forest, he worked on the ecology team for the Chugach National Forest. He has worked on prescribed burning for moose winter range improvement in south-central Alaska. He produced a Sensitive Plant Guide for the Toiyabe National Forest. He, along with the other authors of this Field Guide, has also developed a Field Guide for Central Nevada Riparian areas. He is skilled with computer data analysis methods and has written several programs for field application of ecological scorecards. He has also written a computer program to assist in identification of Sierra Nevada *Carex* species.

DESIDERIO C. ZAMUDIO is a soil scientist and hydrologist with the Humboldt - Toiyabe National Forest. He holds a B.S. degree in soil and water science from the University of California, Davis and a M.S. degree in hydrology - hydrogeology from the University of Nevada, Reno. Prior to working on the Humboldt - Toiyabe, he worked on ecology teams for the Klamath and Inyo National Forests and did soil survey work for Modoc and Inyo National Forests. He served as a hydrologist for the Klamath National Forest and for Bureau of Land Management in Ely, NV and Cedarville, CA. He has published papers relating ecological classification to soil forming factors and ecological status to soil quality indices. He is interested in natural resource accounting and the economic valuation of watershed function. "Desi" has served as president for the Nevada Section, Society for Range Mangement and for the Nevada Chapter, Soil and Water Conservation Society.

KAREN A. ZAMUDIO is an ecologist with the Humboldt - Toiyabe National Forest. She holds a B.S. degree in wildlife and fisheries biology from the University of California, Davis and a M.S. degree in rangeland ecology from the University of Nevada, Reno. Prior to working for the Humboldt - Toiyabe she worked on ecology teams for Modoc, Shasta-Trinity and Inyo National Forests, as well as in the Pacific Southwest Regional office in San Francisco. She was also a district range staff officer on the Milford District of the Plumas National Forest. She has worked on wildlife, range and fisheries research projects for Bureau of Land Management, in Alturas, CA and Carson City, NV; the US Fish and Wildlife Service in Red Bluff, CA and Fallon, NV and; California Department of Fish and Game in Wendel, CA.

ACKNOWLEDGEMENTS

This work is only possible through the combined efforts of a number of people. We are grateful to our supervisors: Jerry Grevstad, Gloria Flora, Mary Wagner, Ron Burraychak, Gary Sayer and "Jim" Nelson for their support of our work and their efforts to keep us focused on producing a useful field guide. Mary Manning and Wayne Padgett provided us with a sound foundation in their community type classification from which to advance. Numerous specialists in the Forest Service and outside the agency all offered their observations, insights and advice. We have enjoyed working with our peers and hope that we have given them some insights as well. The Ranger Districts have provided us with assistance on pack trips and in general. Thanks to Lisa Sims, Jane Schmidt and Kathy Lucich. We especially need to thank our field crews who provided so much enthusiastic assistance with plant identification and soil description, to say nothing of brute force labor and companionship in the mountains. Many thanks to: Amy Payne, Amy MacCollough, Victoria Dotson, Rich and Marie Asbury, Dora Noton, Daniel C. Henklein, Kerwin Dewberry and Brian Watts.

TABLE OF CONTENTS

INTRODUCTION - Chapter 1

Objectives 1-1

Scope 1-1

Climate 1-2

Geology and Physiology 1-3

Fluvial Surfaces and Soils 1-3

Floristics 1-4

CLASSIFICATION CONCEPTS AND TERMINOLOGY - Chapter 2

Classification 2-1

State and Transition Model 2-1

Thresholds 2-2

ECOLOGICAL TYPE IDENTIFICATION AND ECOLOGICAL STATUS DETERMINATION - Chapter 3

Riparian Ecological Type Key for the Eastern Sierra Nevada Region 3-3

Site Characteristics 3-8

Key to Riparian Plant Community Types of the Eastern Sierra Nevada Region 3-11

Determining Ecological Status 3-23

ECOLOGICAL TYPE DESCRIPTIONS AND SCORECARDS - Chapter 4

Artemisia cana/Mesic graminoid -- Pachic Haplocryoll -- Drainageway ecological type 4-2

Dry graminoid -- Typic Haplocryoll -- Trough drainageway ecological type 4-8

Poa cusickii ssp. epilis -- Aquic Haplocryoll -- Trough drainageway and Floodplain ecological type 4-14

Carex scopulorum -- Typic Cryaquoll -- Trough drainageway ecological type 4-20

Carex utriculata -- Oxyaquic Haplocryoll -- Floodplain ecological type 4-26

Carex nebrascensis -- Typic Cryaquoll -- Drainageway ecological type 4-31

Mesic graminoid -- Oxyaquic Haplocryoll -- Drainageway ecological type 4-37

Salix eastwoodiae -- Cryaquoll -- Floodplain ecological type 4-44

Warm willow -- Oxyaquic Cryorthent -- Gravel bar ecological type 4-50

Warm willow -- Typic Cryaquent -- Floodplain ecological type 4-56

Cold willow/Mesic graminoid -- Cryaquoll -- Floodplain ecological type 4-62

Cold willow/Mesic forb -- Haplocryoll -- Floodplain ecological type (no scorecard) 4-67

Populus tremuloides/Mesic graminoid -- Haplocryoll -- Floodplain and Stream terrace ecological type 4-70

Populus tremuloides/Tall forb -- Cumulic Haplocryoll -- Trough floodplain ecological type 4-76

Pinus contorta ssp. murrayana/Mesic graminoid -- Haplocryoll -- Stream terrace and Floodplain ecological type 4-82

Pinus contorta ssp. murrayana/Salix spp. -- Cryaquoll -- Floodplain ecological type 4-88

APPENDICES

A. References

B. Index

C. Field Methods Used in Classifying Ecological Types and Developing Scorecards

D. Office Methods Used in Classifying Ecological Types and Developing Scorecards

E. Soil Characteristics by Ecological Type

F. Illustrated Riparian Indicator Species

G. Plant Species Ecological Indicator Values

INTRODUCTION

Current Forest Service policy puts emphasis on riparian management, classification and inventory. Riparian ecological types are units of land that differ from each other in their ability to produce vegetation and respond to management (USDA, Forest Service, 1991). Management planning and restoration of degraded riparian systems requires knowledge of the potential natural communities and restoration scenarios for each ecological type. Because they are based on site potential, ecological types are important classification labels for inventory and monitoring.

Objectives

This handbook provides methods to determine:

1. Ecological type and current ecological status,

2. Minimum data needed for determining trends in site conservation.

Ecological type scorecards provide a standardized system for determining the current ecological status of different sites using features of both vegetation and environment. In designing scorecards to meet this objective, a riparian ecological type classification is needed to cover commonly encountered riparian settings on Forest Service administered lands on the eastern Sierra Nevada front. The classification must describe general geographic, topographic, edaphic, hydrologic, floristic and functional features of each riparian ecological type. Such a classification assures that only reasonable, attainable potentials are assigned to each site.

Scope

Keys and scorecards in this handbook were developed from data collected from 249 plots sampled on the Bridgeport and Carson Districts of the Toiyabe National Forest during 1994 through 1997 field seasons. The study area includes subwatersheds of the Walker, Carson and Truckee rivers in the Sierra Nevada, Sweetwater Mountains, Excelsior and Carson ranges. Many riparian plant communities are distributed beyond the study area boundaries. Use of ecologically based scorecards may be extended to adjacent areas where site and species requirements are met, with only minimal additional validation sampling. Some of the ecological types in this handbook are similar to those described by ecologists working in the same and adjacent areas. Other riparian classifications have been worked on by the authors of this publication (1996), Manning and Padgett (1995), Nachlinger (1985), Ratliff (1982), Smith (1998 draft) and Hicks (in process).

The scope of this work is limited to freshwater wetlands adjacent to seeps, springs, streams or lakes. It does not include the aquatic ecosystem, intermittent- nonriparian-vegetated draws, nor upland expressions of riparian species such as aspen. Both vegetation and landform should indicate the influence of increased moisture above that found on adjacent uplands. At least 20% cover of riparian species is a good indicator. *Artemisia cana* is considered a riparian species in this volume. Fluvial landforms include drainageways, floodplains and terraces that are shaped or leveled by the meandering action of the stream. Fluvial deposits are often trough-shaped in cross-section. Fluvial deposits can be identified by distinct layering of coarse and fine material. Lakeside landforms are usually cirques. Surface soils in riparian areas also generally have darker color values than those on adjacent uplands.

The areas sampled are typical of those found in Major Land Resource Areas 22 - the Sierra Nevada Range, and 26 - Carson Basin and Mountains (USDA, Soil Conservation Service, 1981). These areas are also described as parts of the Sierra Nevada - M261E, and Mono Basin 341D Sections of the Ecological Subregions of the United States

(USDA, Forest Service, 1994) and Ecological Subregions of California, Section and Subsection Descriptions (USDA, Forest Service, 1997).

Climate

The eastern Sierra is characterized by intense rainshadow effects from the crest of the range. Most runoff in the region is derived from snowmelt and base flow associated with high elevation watersheds. Rare, intense summer storms provide the bulk of the runoff in ephemeral lower elevation drainages. Local topography and elevation wield major influence on precipitation patterns and amounts. Precipitation patterns and amounts vary year to year as well. Climate records show that 65 to 85 percent of annual precipitation comes during the period from October through April, mostly as snow.

Cool temperatures prevail yearlong. Mean annual temperatures are less than 10 degrees Celsius (50 degrees C). The frost free period of the growing season ranges from less than 30 days to 100 days. At least two thirds of the study area has a frost free period less than 70 days. In general, all riparian areas along the eastern Sierra Nevada were in the cold, cryic soil temperature class. A comparable upland cold environment occurs in the Canadian Great Plains. Temperature limits plant growth, growing season and regrowth as well as soil microbial processes.

Snowmelt-dominated drainages of the eastern Sierra are characterized by prolonged spring runoff and high base flow. Watershed area is less than 1,000 square miles and river length less than 60 miles. The three major rivers are characterized below:

River	Length (mi.)	Watershed area (sq.mi.)	Peak Discharge (cfs)	Date
Carson	46	280	15,100	Jan. 31, 1963
Truckee	60	930	17,500	Nov. 21, 1950
Walker	47	360	6,500*	Dec. 11, 1937

* Based on West Walker River Flows

Stream flow is highly variable in time, both within and between years. Peak flows can be up to five orders of magnitude greater than minimum flows. Annual volumes can be twenty times greater in very wet years than in very dry years (Kattleman, 1996). Ephemeral drainages have rare flood flows with rapid hydrograph response and exceptionally coarse load. Base flow is nonexistent in some drainages.

Sediment yields are relatively low except in drainages where glacial till is being reworked by the streams or geological material is unstable. Semiarid ephemeral drainages get coarse debris flows in summer floods.

Geographic estimates of moisture and temperature have been highlighted in the development of soil taxonomy. Soil moisture regimes in Soil Taxonomy (USDA-Soil Conservation Service, 1975) are used to classify soils and map units. The regimes apply well in major crop growing areas, where soil survey efforts date back to 1899. The regimes do not apply as well in wildland, such as National Forests or wetlands with only recent survey efforts. In a general way, riparian areas along the eastern Sierra Nevada commonly can be classified in the ustic or aquic moisture regimes. Soils in an ustic regime have limited moisture in the soil during the growing season. However, this moisture class is not supposed to be used with cold, cryic temperature regimes that prevail in the eastern Sierra Nevada. These ustic-cryic areas are too cold for grain culture

and have limitations for native pastures. An aquic moisture regime pertains to soils saturated with water and chemically reduced - lacking dissolved oxygen. Key field indicators of chemically reduced conditions are organic peat or muck soil material in bogs or fen habitats. Thin layers of peat or muck or muck mixed in mineral soil are also key indicators of aquic conditions, hydric soils and jurisdictional wetlands (Federal Interagency Committee for Wetland Delineation, 1989). A second major class of field indicators are redoximorphic features. These are the familiar iron oxide concentrations (mottles with diffuse boundaries and colors), gleyed (yellow, green or blue colored) and iron depleted (low chroma) soil horizons. The depth to saturation and to field indicators are relevant in classifying soils, ecological types and wetlands. Field indicators for carbon (peat or muck) and iron depletion or concentration in the upper 30cm denote hydric soil and jurisdictional wetlands. Within the upper 50cm, redoximorphic features denote aquic condition using soil taxonomic classes. Thick peat (fibric), mucky peat (hemic) or muck (sapric) layers are used to classify organic soils, histosols. Redoximorphic features, within 100cm are described by the subgroup aquic modifier. When soils are saturated, yet lack redoximorphic features, the subgroup modifier is oxyaquic. This oxyaquic condition is common along the eastern Sierra Nevada.

Geology and Physiography

Watersheds of the Truckee, Carson and Walker Rivers originate on the granitic batholith of the Sierran crest. They are characterized by steep, rocky upper reaches. Glaciation has carved cirques with small lakes into these high elevation headwaters. As the streams descend the eastern escarpment they enter zones of volcanic and tectonic activity. Geology and landform change. Large meadow systems are characteristic of middle elevations. Volcanic tuff and conglomerates occur in some of these drainages. At lower elevations, approaching the alluvial fan piedmont slopes, streams tend to be steeper, and more influenced by faulting at the base of the Sierran mountain block. Springs, some geothermal in nature, affect the hydrology of primary drainages. The Excelsior and Sweetwater mountain ranges laying east of the Sierra are somewhat transitional between the Sierran and Great Basin physiographic provinces. They are less dominated by granitic batholiths yet have their own geologic mixtures. They are also characterized by fracture zones, effecting landform, slope and groundwater hydrology.

Fluvial Surfaces and Soils

Riparian soils and fluvial surfaces occur in depositional environments. They catch, mix and redistribute sediment from upstream and adjacent uplands. Different fluvial surfaces are characterized by different sediment deposition rates. A principle sediment sorting process is lateral migration of stream channels. A second process which is closely associated with the nature of vegetation is flooding and fine sediment capture. The initial deposit of coarse material is a **gravel bar**. As fine material collects on the gravel bar it becomes a floodplain. **Floodplains** consist of sequential layers of coarse bed material overlaid by fine deposits (Mackin, 1937; Leopold, Wolman, and Miller, 1964). **Drainageways**, in contrast to floodplains, lack defined channels causing layers of fine flood material to be deposited across the entire cross-section. **Stream terraces** are relics of floodplains that have been incised. Incised streams have cut through the coarse bed material into the underlying sequence of fine or coarse material from prior depositional events. Over time, floodplains and stream terraces are carved out or filled in with sediments. Drainageways and floodplains may be nested within stream terrace landscapes. Faulting is common in the eastern Sierra. Springs occurring along fault lines are designated **fault-line spring** landforms.

Fluvial soils are formed from parent material of mixed origin. The short and long term depositional environment of a given site dictates material sizes and degree of contrast between layers of fine and coarse material in a given soil. Entisols, soils of little development, were found on gravel bars. These soils are characterized by having only A

and C horizon designations. The A horizon may have slight color change and minimal structure. The C horizon is essentially undifferentiated sediments. As organic rich fine sediments accumulate on a gravel bar, the soil progresses through a succession from Entisols to Inceptisols to Mollisols in a short time. Succession may occur in decades on depositional riparian sites in contrast to centuries on upland sites . In going from an Entisol to an Inceptisol, soil organic matter is sufficient to form the A, B, and C soil horizons. B horizons have distinct soil structure. Mollisols have sufficient organic matter and biological activity for distinctive soil structure and dark color.

Willow ecological types were the best examples of the Entisol to Mollisol soil succession. Understory plant succession within these willow ecological types mirrors soil succession. The Warm willow ecological types are dominated by Entisols. Cold willow ecological types have an even mix of Entisols and Mollisols. Lodgepole pine ecological types also show the Entisol to Mollisol development.

Aspen and meadow ecological types are generally associated with Mollisols, indicating stable depositional environments. The *Carex scopulorum* ecological type is an exception; fifty percent of sites sampled had Entisols or Inceptisols.

The meadow ecological types partition the moisture gradient from wet to moist to dry. However, even the meadow types are more moist than adjacent uplands. A common dry meadow soil is the Haplocryoll group. There is a good relationship between average depth to saturation and ecological type within the moist to wet meadows. The relationship between average depth to mottles, redoximorphic features, and ecological type is not so clear. Almost a third of the moist to wet meadows are oxyaquic, saturated without mottles. Common moist meadow soils are Oxyaquic Haplocryolls and Aquic Haplocryolls. Common wet meadow soils are Oxyaquic Haplocryolls and Typic Cryaquolls. The aquic modifier indicates that redoximorphic features and saturation are below 50cm and the "aqu" in the great group name indicates the redoximorphic features and saturation are within 50cm of the surface.

Four wet meadow ecological types, four willow types and one lodgepole pine type fit the criteria for jurisdictional wetlands. It is especially important to maintain the ecological function of these types as well as conserve their extent.

Floristics

The study area includes portions of the Sierra Nevada Floristic Section and the Reno Floristic Section (Manning and Padgett, 1995). The eastern slope of the Sierra Nevada is included in the Sierra Nevada Floristic Section. The lower slopes of the Sierra Nevada along highway 395 and the Sweetwater Mountains are included in the Reno Floristic Section. The Reno Floristic Section forms a transition between the Sierra Nevada Section and the Lahontan and Central Great Basin Floristic Sections to the east.

The Sierra Nevada Floristic Section

Four broad forest types occur between 6,000 ft. and 8,900 ft. elevation within the study area : subalpine mixed conifer forest, red fir forest, eastside Sierra mixed conifer forest and yellow pine forest.

The subalpine mixed conifer forests occur from timberline to about 8,000 ft. depending on local parent material, slope, aspect and soils. This type is dominated by whitebark pine (*Pinus albicaulis*), lodgepole pine (*Pinus contorta ssp. murrayana*), western hemlock (*Tsuga mertensiana*), and western white pine (*Pinus monicola*). Stands of Sierra juniper (*Juniperus occidentalis*) also are found here. Common riparian willow shrub species include Eastwood's willow (*Salix eastwoodiae*), *Salix orestra, Salix planifolia* and Booth's willow (*Salix boothii*). Thinleaf alder (*Alnus tenuifolia*) also occurs here. Common riparian herbaceous species found in the higher meadows include

mountain sedge (*Carex scopulorum*), Nebraska sedge *(Carex nebrascensis*), black sedge (*Carex subnigricans*), alpine aster (*Aster alpigenus*), and wandering daisy (*Erigeron peregrinus*). Threadleaf sedge (*Carex filifolia*) occurs in drier meadows.

The red fir forest is dominated by stands of red fir (*Abies magnifica*). Riparian plant species form a transition between the higher elevation subalpine forest and the eastside mixed conifer forest.

The eastside mixed conifer forest occurs between about 8,000 feet and roughly 6,500 ft. Dominant tree species are lodgepole pine (*Pinus contorta ssp. murrayana*), Jeffrey pine (*Pinus jeffreyi*) and white fir (*Abies concolor*). Quaking aspen (*Populus tremuloides*) occurs in riparian areas in this zone. Common riparian willow species are Booth's willow (*Salix boothii*), Lemmon's willow (*Salix lemmoni*) and Geyer's willow (*Salix geyeriana*). Common riparian meadow species inculde beaked sedge *(Carex utriculata*), Nebraska sedge (*Carex nebrascensis*), shortbeak sedge (*Carex simulata*), hairy sedge (*Carex lanuginosa*), Baltic rush (*Juncus balticus*), Kentucky bluegrass (*Poa pratensis*) and western mountain aster (*Aster occidentalis*).

The yellow pine forest occurs from about 6,500 ft. down to about 5,500 ft. and is dominated by Jeffrey pine, white fir and incense cedar. This forest is drier than the eastside mixed conifer forest. Aspen stands and black cottonwood (*Populus trichocarpa*) are found in this zone. Common riparian willow specis found here are in the warm willow category and include coyote willow (*Salix exigua*), and yellow willow (*Salix lutea*). Common riparian herbaceous species include Nebraska sedge, Douglas sedge (*Carex douglasii*), Kentucky bluegrass, Baltic rush and yarrow (Achillea millifolium).

Reno Floristic Section

This section is about 230 miles long and extends from the Virginia Mountains west of Pyramid Lake south to the White Mountains east of Bishop, California. This section is predominately in the rain shadow of the Sierra Nevada and so is drier than the Sierra. Riparian areas tend to be drier and less extensive than in the Sierra Nevada to the west. Some Sierran tree species occur sporadically in this floristic section includeing white fir and lodgepole pine above 8,000 ft. Below this elevation, lies a belt of pinyon pine (*Pinus monophylla*) and Utah juniper (*Juniperus osteosperma*) to approximately 5,000 ft. elevation. Below the pinyon-juniper zone is a sagebrush-grass zone which occupies the vallys and lower slopes. Sagebrush species include Wyoming big sagebrush (*Artemisia tridentata ssp. wyomingensis*) and mountain big sagebrush (*Artemisia tridentata ssp. vaseyana*).

Common riparian willow species in this section include coyote willow, yellow willow, and arroyo willow (*Salix lasiolepis*). Quaking aspen is found occasionally in riparian areas in this section. Black cottonwood is found at the lower elevations along perennial stream courses. Common herbaceous riparian plants include Kentucky bluegrass, redtop (*Agrostis stolonifera*), Nebraska sedge, Baltic rush, meadow penstemon (*Penstemon rydbergii*), and wester mountain aster *(Aster occidentalis*)

CLASSIFICATION CONCEPTS AND TERMINOLOGY

Classification

Classification is a tool used to help make predictions about responses to management and manipulation. Classification allows for comparison of differences and similarities among soils or units of land or vegetation. Such comparisons are used to determine whether experience at one place is applicable to other places. In ecological classification, real units of land are grouped or separated into classes based on differentiating properties. Not all combinations of properties are considered likely to occur. Only naturally occurring, observed units of soil, vegetation or land are included in the classification. Differentiating properties are those which most accurately influence the most important predictions relative to management and which are readily observable in the field.

Several classifications are considered in this field guide. First, soils are classified into functional units through Soil Taxonomy (USDA, Soil Conservation Service, 1975). This classification system differentiates soils based on their formation processes and abilities to support different types of vegetation. Second, vegetation is classified into plant communities based on differences in species composition. Third, ecological types are differentiated on the basis of both soil and plant community characteristics. The ecological type is the basic unit of land classified and described in this document. **Ecological types** have unique combinations of biotic (plant and animal species) and abiotic (landscape, soils and climatic) features; they differ from each other in their ability to produce vegetation and respond to management (USDA, Forest Service, 1991). Fourth, ecological status is classified in each ecological type using indicators of site stability, hydrologic function and soil and plant community integrity. Finally, attempts are made to relate ecological types and ecological status to classifications developed for other purposes. For example, the classification of jurisdictional wetlands.

State and Transition Model

Ecological types may be expressed at various stages of development or degradation by several plant community types. Each of these plant communities represents a different state. Similarly, soil structure and aggregate stability vary among states within the same ecological type. **Potential natural community (PNC)** is the biotic community that would be established if all successional sequences were completed without additional human-caused disturbance, under present environmental conditions. Grazing by native fauna, natural disturbances such as drought, floods, wildfires, insects and disease, are inherent in the development of potential natural communities that may include naturalized nonnative species (USDA, Forest Service, 1991). The **historic climax plant community (HCPC)** (USDA, Natural Resources Conservation Service, 1997) is a similar concept. Potential natural communities correspond to plant communities with root networks that fill the soil volume (Weaver, 1919). In contemporary terms, they are sites with good soil health or soil quality (Doran and Parkin 1994) as well as indicators of rangeland health (Busby et.al., 1994). The so called "undisturbed" state also corresponds to the high humus production state in an extensive root-soil environment. Humus accumulation in soils with extensive roots effectively stabilizes soil aggregates. The potential natural community provides a reference standard to which existing plant communities can be compared.

Transitions to other states are reflections of changes in site conditions. Some sites shift to another state relatively easily and in a short time. Others may be more resistant to change and are long-lived. **Succession** is the process through which plant species composition and soil characteristics change together over time, going toward an "undisturbed" state. The degree of similarity between the existing vegetation and soil water conditions and those at PNC is the **ecological status** of a site. Within each

ecological type three classes of ecological status are described by multiple discriminating vegetation and soil water features. These features are also considered rangeland health ecological attributes in the National Range and Pasture Handbook (USDA, Natural Resource Conservation Service, 1997). They include features such as: bare ground, infiltration, indicator plant species groups, and litter distribution and amount. **Retrogression** is the disturbance pathway leading away from PNC, resulting from the decline or destruction of vegetation and soil water features such as root systems (Hillel, 1980). An example would be a shift from deep-rooted, palatable plant species to shallow-rooted, less palatable species in a meadow. This shift is significant in terms of both erosion control on the site and forage for animals. Microbial activity associated with root growth and death results in dynamic succession and retrogression with the soil. In riparian areas the dynamic nature of deposition and erosion, superimposes additional cycles of succession and retrogression. **Secondary succession** is succession that takes place following retrogression. Secondary succession may not follow the same pathway(s) as retrogression. Descriptions and scorecards of each ecological type try to show how plant communities are related on seral pathways.

Thresholds

Species indicative of low similarity to PNC may dominate the site for an indefinite period without some form of drastic alteration of the site. In other words, the site may retain the capacity to recover up to the threshold point, beyond which it may not readily return to its former state.

The conservation threshold represents the point at which: (1) the species representing low similarity to PNC begin to dominate; (2) there is a significant decrease in the infiltration rate; (3) there is a significant decrease in the rooting depth of a fibrous root network.

The Society for Range Management's Task Group on Unity in Concepts and Terminology (1995) defines the Site Conservation Threshold as the kind, amount and/or pattern of vegetation needed as a minimum on a given site to prevent accelerated erosion. The Site Conservation Threshold (or Rating) may be estimated using one or more parameters of the vegetation as well as soil surface characteristics. These parameters are specific to each ecological type.

A **conservation threshold** identifies the transition between loss and gain in soil material and associated biota. A similar concept (base level) describes the threshold between erosional and depositional environments. Below the base level, there is a net gain in rock minerals as sediments accumulate. The major trend is aggradation yet there are cycles of intermittent erosion. Periodic floods may erode or aggrade fluvial soils. The major trend for fluvial soils above the conservation threshold is aggradation or deposition with periodic floods. Yet soils differ from geologic material by being dynamic microbial factories. A soil may decline in soil water balance and associated biota without an obvious decline in rock minerals. A decline in water balance is associated with a decline in root networks, microbial volume and with accelerated erosion. The accelerated erosion along a floodplain or drainageway is often subsurface. Leopold, Wolman and Miller, (1964) describe piping as the removal of humus, fine earth and rock minerals below the soil surface by lateral water flow. The materials are necessary to sustain plant growth. Without an index of subsurface accelerated erosion, piping can progress into a gully undetected.

Especially in grassy or grass-like species dominated sites, the threshold distinguishes the ecological status classes on the basis of water use efficiency. Most water movement into or through a soil is along root channels. Above the conservation threshold, roots form an extensive vertical network. Below the conservation threshold, rooting density is reduced to the few larger size roots, and those roots follow soil plates laterally. Overall,

the vertical pathway for water is limited when ecological status falls below the threshold. In addition to rerouting roots, platy soil structure produces a tortuous path for water movement. Both infiltration from the soil surface and water transport up from the water table are impeded.

ECOLOGICAL TYPE IDENTIFICATION AND ECOLOGICAL STATUS DETERMINATION

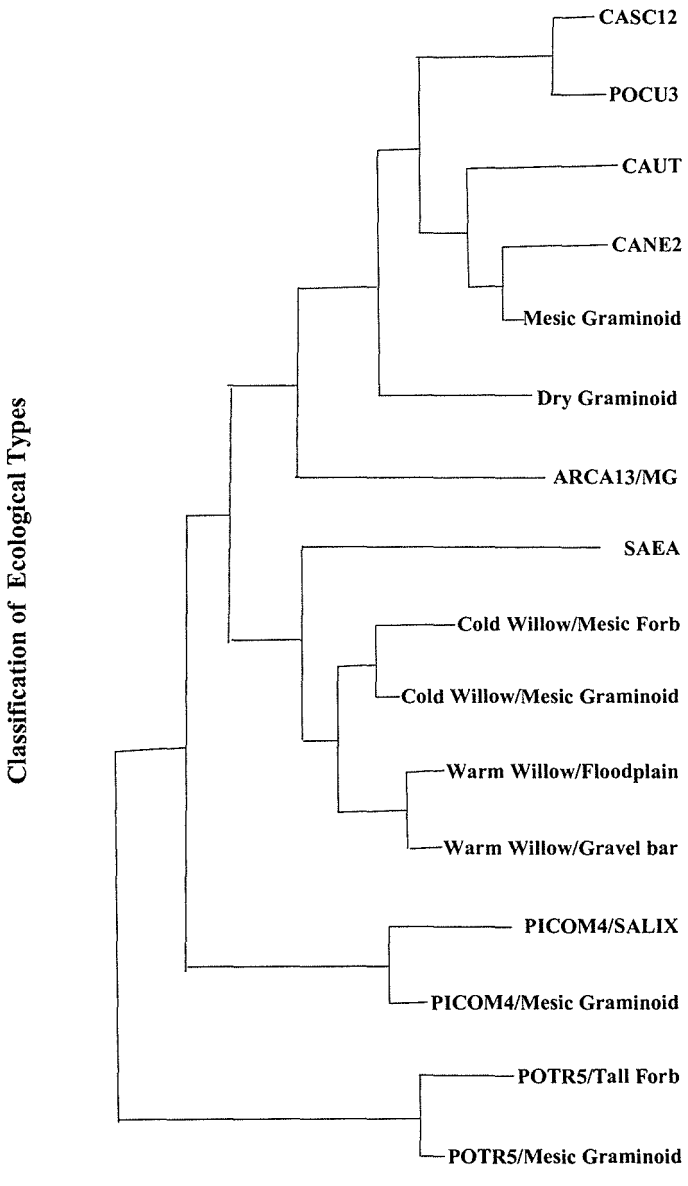
Ecological types are products of the coevolution of soils and vegetation on a site. They are described in terms of soil, water, climate and plant diversity. To identify an ecological type and assess it, one needs to practice an integrated method of observation. Training can improve awareness of those parts of the ecosystem that one might not be familiar with. Therefore, training in soil feature identification and measurement is recommended for plant scientists, and plant identification and measurement training is recommended for earth scientists.

There are several steps in arriving at the ecological status of a given site. First, boundaries of the site must be identified based on landform and vegetation. Next, to key the site to its ecological type, landform, lateral slope, depth to saturation, soil temperature and current plant community need to be known. After the ecological type is identified, then the appropriate scorecard is used to determine ecological status.

It is important to select a site that is homogeneous in both landform and vegetation. Within the riparian zone, walk around and find the boundaries of the various fluvial surfaces and plant communities. Several riparian ecological types may exist side-by-side in a broad riparian area. You need to determine the ecological status of each type individually because each scorecard is applicable only to that specific ecological type.

Dig a soil pit near the center of the homogeneous site in a representative area. The pit should be deep enough to record soil temperature, rooting depth and if possible, depth to water table. A one meter depth is adequate. Often, a series of auger holes systematically placed across the site will give a better picture of variability and more accurate average values. While working through the key, use the following instructions to supply information on physical site measurements and to identify plant communities.

The following page is a diagrammatic representation of the key to riparian ecological types. The first several divisions are based on structure of the plant community. Woody ecological types are separated from herbaceous types. In the absence of distinctive vegetation; i.e., after a flood or fire, careful attention should be paid to depth to rock fragments in the soil, landform and lateral slope.


Classification of Ecological Types
CASC12
POCU3
CAUT
CANE2
Mesic Graminoid
Dry Graminoid
ARCA13/MG
SAEA
Cold Willow/Mesic Forb
Cold Willow/Mesic Graminoid
Warm Willow/Floodplain
Warm Willow/Gravel bar
PICOM4/SALIX
PICOM4/Mesic Graminoid
POTR5/Tall Forb
POTR5/Mesic Graminoid

Riparian Ecological Type Key for The Eastern Sierra Nevada Region

Plant community and environmental data identify the ecological type of any given site. At each juncture in the ecological type key, compare the key character with measured values from the plot. Descriptions of site characteristics and a plant community key are provided in the following sections. A crosswalk between scientific and common names is provided in Appendix G. Ranges of one standard deviation are indicated by $\pm$ values; these ranges characterize 66% of our samples. The range of actual measured values is listed without $\pm$ s. Once a tentative selection is made, compare the site with the written narrative description of the ecological type. If the description does not fit, try again.

Environments/plant communities which will not key are those with greater than 35% conifer cover (other than lodgepole). Plant communities dominated by rose or cottonwood were not sampled and will not be found in this key although they occur in the Eastern Sierra Nevada Region.

1. Aspen (*Populus tremuloides*) has greater than 10% cover. The understory may be willows, alder or graminoids. Lateral slope and valley slope tend to be steeper and more variable . Soil temperatures tend to be colder. Temperature at 50cm depth averages 9.4 $\pm$ 2.5 °C. Found primarily on floodplains (68%). Soils classed as Haplocryolls 79% of the time.

   go to Aspen subgroup (14)

1'. Meadow sites or woody sites where the overstory is dominated by species other than aspen. Lateral slope and valley slope tend to be less steep and less variable. Lateral slope averages 2.9 $\pm$ 3.3 %. Valley slope averages 3.7 $\pm$ 3.9%. Soil temperatures tend to be warmer. Temperature at 50cm depth averages 11.1 $\pm$ 2.8 °C.

   go to 2.

2. Lodgepole pine (*Pinus contorta ssp. murrayana*) has greater than 10% cover. The understory may be willows, currents or graminoids. It is uncommon to reach a stream bed layer within a meter of the surface. A stream bed layer consists of greater than 60% by volume rock fragments.

   go to Lodgepole subgroup (15)

2'. Meadow sites, silver sagebrush or willow sites. There is a 50% chance of encountering a stream bed layer in digging a pit to one meter depth. A stream bed layer consists of greater than 60% by volume rock fragments.

   go to 3.

3. Willow species (*Salix spp.*) are found in the overstory with greater than 10% cover. Found more frequently on floodplains with steeper lateral slopes. Rock fragments in significant amounts (> 35%) are found more shallowly in the profile.

   go to Willow subgroup (10)

3'. Meadow sites or sites with silver sagebrush (*Artemisia cana*) as an overstory species. Found more frequently in drainageways with shallower lateral slopes. Rock fragments are less frequent or deeper in the soil profile.

go to 4.

4. Silver sagebrush has greater than 5% cover on the site. Most of these sites are on Pachic Haplocryolls (92%). Depth to 35% rock fragments is 59 ± 41cm.

***Artemisia cana*/Mesic graminoid -- Pachic Haplocryoll -- Drainageway ecological type**

4'. Meadow sites dominated by graminoids, grass-likes or forbs with no significant woody overstory. Depth to 35% rock fragments is 92 ± 52cm.

go to 5.

5. Meadow sites with graminoid and grass-like dominated vegetation. Dominant plant species include *Poa cusickii, Carex scopulorum, Carex subnigricans, Carex utriculata, Carex nebrascensis, Juncus balticus and/or Poa pratensis*. Most soils have saturation OR redoximorphic features within 1 meter of the surface late into the growing season. Soil temperature at 50cm averages 10 °C.

go to 6.

5'. Meadow sites with graminoid and grasslike dominated vegetation. *Carex douglasii* and *Poa secunda ssp. juncifolia* are common dominants. Most soils lack saturation and redoximorphic features within 1 meter of the surface, at least by midsummer. Soil temperatures are warmer; at 50cm depth it averages 14 ± 2 °C.

Dry graminoid -- Typic Haplocryoll -- Trough drainageway ecological type.

6. Meadow vegetation dominated by *Carex nebrascensis, Poa pratensis, or Carex utriculata*. Haplocryoll soils 50% of the time. Warmer soil temperatures. Temperature at 20cm averages 12 ± 3 °C. At 50cm the temperature averages 11 ± 3 °C. Elevation averages 7400 ±1000 ft.

go to 8.

6' Meadow vegetation dominated by *Carex subnigricans, Carex scopulorum* or *Poa cusickii ssp. epilis*. Boroll soils less common (28%). Soil temperatures are cooler. Temperature at 20cm averages 11 ± 3 °C. At 50cm the temperature averages 9 + 2 °C. Elevation tends to be higher. The average elevation is 8800 ± 560 ft.

go to 7.

7. Meadow vegetation includes *Poa cusickii ssp. epilis*, *Carex nebrascensis, Trifolium longipes, Juncus balticus* and/or *Carex praegracilis.* Evenly distributed between trough drainageways and floodplains. Generally, rock fragments of a stream bed layer are found within 1 meter of the surface.

Poa cusickii ssp. epilis **-- Aquic Haplocryoll -- Trough drainageway and Floodplain ecological type**

7'. Meadow vegetation dominated by *Carex* species, primarily *Carex scopulorum* and *Carex subnigricans*. Found preferentially in drainageways (65%) and then on floodplains (20%). Haplocryolls are the most common soil great group. Redoximorphic concentrations are common in the upper soil profile (61%).

Carex scopulorum **-- Typic Cryaquoll -- Trough drainageway ecological type**

8. Meadow vegetation dominated by *Carex utriculata* or *Carex vesicaria.* Water is ponded or soils are saturated at the surface well into flowering. Drainage may occur late in the growing season. Depth to saturation averaged 18cm, yet redoximorphic features are uncommon. Peat and muck layers occur in 64% of soil profiles.

Carex utriculata **-- Oxyaquic Haplocryoll -- Floodplain ecological type**

8' Meadow vegetation dominated by other graminoid species.

go to 9.

9. *Carex nebrascensis* , *Poa pratensis, Juncus balticus, Deschampsia cespitosa* and *Carex simulata* commonly dominate the vegetation. Most common soils were Typic Cryaquolls or saturated Oxyaquic Haplocryolls. Most soils are saturated within 50cm of the surface. Depth to saturation averaged 34cm. Most soils have redoximorphic features.

Carex nebrascensis **-- Typic Cryaquoll -- Drainageway ecological type**

9'. Vegetation dominated by grasses and sometimes grasslikes other than *Carex nebrascensis.* Most common dominants are *Juncus balticus, Poa pratensis, Carex praegracilis,* and *Juncus orthophyllus. Iris missouriensis* may dominate in disturbed sites. Generally saturation is encountered below 50cm. Most soils lack redoximorphic features.

Mesic graminoid -- Oxyaquic Haplocryoll -- Drainageway ecological type.

10. Willow dominated sites above 8400ft. Primary willow species on these sites are *Salix eastwoodiae, Salix orestra* and/or *Salix planifolia* .

Salix eastwoodiae **-- Cryaquoll -- Floodplain ecological type**

10'. Willow dominated sites below 9000 ft. Primary willow species on these sites include *Salix exigua, Salix lemmonii, Salix boothii, Salix lutea and Salix geyeriana, Salix lucida, Salix lasiolepis.*

go to 11.

11. Lower elevation sites dominated by *Salix exigua, Salix lasiolepis, Salix lutea* and/or *Salix lucida*. Elevation ranges from 5400 to 7600 ft. Soil temperatures are warm. At 20 cm depth the average is 13.1 $\pm$2.5 °C, at 50cm depth the average is 12.6 $\pm$ 2.2 °C.

go to 12.

11'. A little bit higher and cooler sites dominated by *Salix geyeriana, Salix boothii, Salix lemmonii*. Elevation 5800 to 9200 ft. Soil temperature at 20cm depth averages 11.3 $\pm$ 1.9 °C. At 50cm temperature averages 10.4 $\pm$ 2.1 °C.

go to 13.

12. Sites dominated by warm willow species (*S. lutea, S. exigua, S. lucida, S. lasiolepis*) on gravel bars. Soils are classed as Orthents or Aquents. Surface soil material is medium and fine sand, with coarse bed layers on average at 42cm. Temperatures are very warm. At 20cm depth the soil temperature is 14.5 $\pm$ 1.8 °C; and at 50cm depth the temperature is 13.5 $\pm$ 2.3 °C.

Warm willow -- Oxyaquic Cryorthent -- Gravel bar ecological type

12'. Sites dominated by warm willow species (*S. lutea, S. exigua, S. lucida, S. lasiolepis*) but found most frequently on floodplains. Soils on the floodplain had greater accumulation of fine sediments. Surface soil material is fine sand and silts. Most soils have redoximorphic features. Soil temperatures are cooler. At 20cm depth temperature averages 11.6 $\pm$ 2.3 °C. At 50cm depth the temperature is 11.6 $\pm$ 1.8 °C.

Warm willow -- Typic Cryaquent -- Floodplain ecological type

13. Low gradient meadow systems with willow overstories. Valley slope averages 2.4 $\pm$ 2.4 percent. Lateral slope is 3.2 $\pm$ 3.3 percent. Depth to saturation is within one meter of the soil surface and redoximorphic features are common. Depth to field capacity averages 18.5 $\pm$ 34 cm.

Cold willow/Mesic graminoid -- Cryaquoll -- Floodplain ecological type

13'. Steeper gradient systems with herbaceous understories and willow overstories. Valley slope averages 9.4 $\pm$ 7.6 percent. Lateral slope is 5.9 $\pm$ 4.6 percent. Soils are less frequently saturated or even moist. Depth to field capacity is 63 $\pm$ 67cm. Redoximorphic features are found in the soil profile less than half of the time.

Cold willow/Mesic forb -- Haplocryoll -- Floodplain ecological type

14. Aspen sites with graminoid understories. Alder and willow may also be present in the overstory. Depth to field capacity moisture tends to be closer

to the surface. Average depth to field capacity is 27 ± 27cm. Relatively few soils have cumulic or pachic modifiers (33%).

***Populus tremuloides*/Mesic graminoid -- Haplocryoll -- Floodplain and Stream terrace ecological type**

14'. Aspen sites generally with shrub and herbaceous understories. Shrub species include *Salix spp., Ribes spp* and *Symphoricarpos spp.* Understory species include *Osmorhiza spp., Thalictrum, spp. , Aquilegia formosa, Poa wheeleri and Poa pratensis*. Depth to field capacity moisture tends to be deeper. Average depth to field capacity is 53 ± 53cm. More soils have cumulic and pachic modifiers (70%).

***Populus tremuloides*/Tall forb -- Cumulic Haplocryoll -- Trough floodplain ecological type**

15. Lodgepole pine sites with graminoid understories. Moisture is deeper in the profile and soil temperatures are colder. Average depth to field capacity moisture is 50.7 ± 52.3 cm. Depth to saturation averages 98.9 ± 52.7 cm. Soil temperature at 50cm is between 6 and 15 °C with an average of 9 ± 2 °C. Found primarily on stream terraces (40%) and floodplains (33%).

***Pinus contorta ssp. murrayana*/Mesic graminoid -- Haplocryoll -- Stream terrace and Floodplain ecological type**

15'. Lodgepole pine sites with shrub or herbaceous understories. Moisture is closer to the surface and soil temperatures are warmer. Average depth to field capacity moisture is 13.4 ±10.4 cm. Depth to saturation averages 41.4 ± 16.5cm. Soil temperature at 50cm is between 7 and 16 °C. with an average of 13 ± 4 °C. Found primarily on floodplains (90%).

***Pinus contorta ssp. murrayana/Salix spp.* -- Cryaquoll -- Floodplain ecological type**

Site Characteristics

Landform classes are described in the Fluvial Surfaces and Soils portion of the Introduction. They are: **floodplain, gravelbar, drainageway, stream terrace, spring** and **toeslope**. These landforms may be **incised** or not. Often they are trough shaped in cross section.

Valley slope is the measured change in elevation of the floodplain, up or down valley, across the plot, usually over two meander lengths of the stream. Divide the vertical difference in elevation by the horizontal distance across the plot.

Lateral slope is measured perpendicular to valley slope in the direction of hillside to stream. Only that component of lateral slope that crosses the plot is recorded. Stand on the part of the plot or site closest to the stream and shoot a grade level to the part of the plot furthest from the stream and perpendicular to its flow. Do not cross landform boundaries or "average in " other landform slopes.

Soil Moisture is scaled by touch after the USDA Soil Conservation Service's, Guide for Estimating Soil Moisture by Feel and Appearance.

1. Touch the soil profile to identify zones of differing soil moisture using characteristics of the moisture scale below. Obtain samples above and below perceived moisture boundaries.

2. Dig out a fistful of soil (gravels and smaller sizes). Squeeze the sample in your hand to form a ball.

> 1=Warm dry - Appears dry, forms a very weak ball, aggregated soil grains break away easily from ball. **Air dry**.
>
> 2=Cool dry - Slightly moist, forms a ball with defined finger marks, very light staining on the fingers, darkened color, will not slick to a wet sheen. 50% of field capacity.
>
> 3=Moist - Appears wet, forms a soft ball, free water appears briefly on soil surface after squeezing or shaking, leaves muddy film on hand and fingers, can form a ribbon with soil between thumb and forefinger. **Field capacity**.
>
> 4=Wet - Forms a soft ball, free water persists on soil surface after squeezing or shaking, sufficient moisture to wet clothing in contact with soil, leaves a medium to heavy mud film on hand and fingers.
>
> 5=Wet Sponge - Water drips from your hand when you squeeze to form a ball, muddy film on hands often thin or washed. **Saturation**.

3. Compare moisture by touch boundaries to depth in key.

Soil moisture regimes common to the eastern Sierra Nevada riparian areas are **aquic,** and **oxyaquic.** Soil moisture regime is important in defining **jurisdictional wetlands** (Federal Interagency Committee for Wetland Delineation, 1989). Soil in the aquic moisture regime is saturated and has redoximorphic features within 50cm of the surface. Aquic soils are classed as jurisdictional wetlands. Oxyaquic soils are saturated but do not have redoximorphic features within a meter of the surface. These soils may be classed as jurisdictional wetlands if they are saturated within 50cm of the surface and have wetland dependant species such as *Carex nebrascensis* growing in them.

Redoximorphic features identified by three soil color patterns. Redox concentrations of iron oxide appear as yellow and red colors along pore linings, along roots or in soft

masses. These mottled features have diffuse or haloed boundaries and colors. Red specks with sharp edges are relics of past conditions, are not ecologically active and are not considered in the key. Mottles contrast in color with the larger matrix of soil. Most often they are reddish or yellowish in a brown (10YR hue) matrix. Record depth to mottles as the depth at which mottles distinctly contrast with the matrix by at least one page in hue, or one value or chroma. A second color pattern is a matrix of redox depletions where iron loss yields a chroma of 2 or less in a soil layer. The third color pattern is a matrix of gleyed yellow, green or blue colors. Redoximorphic features are important indicators of hydric soils and therefore of jurisdictional wetlands. Detailed descriptions of these color patterns are found in Field Indicators of Hydric Soils in the United States, Version 4.01 (USDA, Natural Resources Conservation Service, 1998a), Keys to Soil Taxonomy (USDA, Natural Resources Conservation Service, 1998b) and Soil Survey Manual (Soil Survey Division Staff, 1993).

Soil color is measured by comparison with a Munsell color chart (Munsell Color Co. Inc., 1992). The Munsell color system uses three elements of color: hue, value and chroma. Hue identifies spectral quality of color based on five principle hues: red, yellow, green , blue and purple. Value indicates degree of dilution of a color by neutral gray of the same value. Chroma extends from zero for neutral colors to 8 for "vibrant" colors.

Colors are identified on both moist and air dry soils. Bright sunlight is ideal for distinguishing among color chips. Color is generally measured on an undisturbed clod surface.

Soil temperature is measured at 20cm and 50cm depth with a thermometer that measures degrees Celsius. The probe should penetrate at least 7.5cm. Our key is designed for midsummer measurements. Spring measurements may be cooler than both values in the key and those in Soil Taxonomy (USDA, Soil Conservation Service, 1975). In the eastern Sierra Nevada, two common soil temperature regimes, as defined by Soil Taxonomy, are cryic and mesic. Cryic is very cold; mean annual soil temperature at 50cm depth is between 0 and 8°C. The mesic temperature regime has a mean annual soil temperature between 8 and 15 °C.

Soil material and texture refer to mineral particles less than 2mm in diameter (sands, silts and clays). Texture is a field determination of mixtures of clays, silts and sands based on their reaction to handling and feel. Sandy loam and silt loam soil texture classes were common in riparian soils of the eastern Sierra Nevada. A more thorough determination of particle size distribution is gained from sieve analysis. The whole soil sample for the surface horizon is shaken through a set of nesting sieves with mesh of sequentially decreasing sizes. Standard sieve sets have mesh sizes in a logarithmic progression. The percent by weight passing each sieve is recorded and cumulative weights are plotted on a graph. Ten percent of the material is smaller than the $\mathbf{D_{10}}$ size. The $\mathbf{D_{50}}$ size is the size of the opening in microns that will pass half of the material by weight. The smaller the D_{50} size, the smaller the particles and the smoother the feel of the soil due to silt and clay particles. The larger the D_{10} and D_{50} sizes are, the more gritty the feel due to sand particles. (See also Appendix C.)

Rock fragments are those particles larger than 2mm diameter and are generally measured in percent by volume in a given horizon. Gravel is between 2mm and 75mm in diameter. Cobbles are between 75mm (3 inches) and 600mm in diameter. Boulders are greater than 600mm (24 inches) in diameter. Fluvial surfaces often have layers of fine and coarse material. The transition from fine to coarse material often occurs at channel bed depth. Gravelly, cobbly or bouldery sites have at least 15% rock fragments in any horizon.

Organic soil materials tend to accumulate in riparian or wetland areas. They occur in thin to thick layers or mixed into the mineral soil layer as dead or decomposed plant

material (Soil Survey Division Staff, 1993 and USDA, Natural Resources Conservation Service, 1998a). **Peat** is composed of dead plant fibers, **fibric** organic material. **Mucky peat** is a combination of fibers and decomposed, **hemic** organic material. **Muck** is composed of decomposed, **sapric** organic material that breaks apart when rubbed. Organic material in histic, sapric or fibric form mixed with mineral material or in thin layers is a field indication of hydric soils (USDA, Natural Resources Conservation Service, 1998a). Histic horizons are thick layers of organic material with little or no mineral fraction. They occur where dead plant material builds up because of slow decomposition rates.

Haplocryoll is a soil class characterized by a dark, soft surface; it lacks redoximorphic features and the summer temperature at 50cm is below 15 °C.

Cryaquoll is a soil class characterized by a dark, soft surface; saturation and/or redoximorphic features are generally with 50cm of the surface. In addition, the summer temperature at 50cm is below 15 °C.

These great groups can be modified by descriptors. If there are no distinguishing features, the soil is classed as a typical version, **typic**. Both pachic and cumulic modifiers refer to soils having distinguishing thick organic rich surface layers. **Cumulic** indicates that deposition of organic matter is irregular. This a common river depositional pattern, while **pachic** describes the even deposition developed under aspen.

Key to Riparian Plant Community Types of the Eastern Sierra Nevada Region

The plant community key is used to identify the current plant community occupying a site. A given plant community that has low similarity to any PNC may represent any one of several ecological types. The physical characteristics that distinguish one ecological type from another are not considered in a plant community key. Once you have keyed out the current plant community, use the riparian ecological type key to determine the potential of a given site.

1. Use this key for riparian communities within the Eastern Sierra Nevada Region.

2. Locate a sample plot in a representative portion of the stand that is homogeneous in vegetation and on one landform surface.

3. Walk around the site and accurately identify and record canopy cover for all species that have at least 15% canopy cover. Start from the tree layer and work down to the shrub layer and then to the herbaceous layer.

4. Check plot data in the field to verify that the plot represents the stand as a whole, using recorded canopy cover values. If not representative, locate another plot.

5. While in the plot, identify the current **Overstory Dominance Group**, and then the current riparian **Community Type** by following the keys literally.

6. Remember that **the key is not the classification**, but only one means of entering the classification.

Key to Overstory Dominance Groups

1. *Populus* species dominate the overstory with at least 25% cover ..... Group A

1. Not as above ..... 2.

2. *Salix* species dominate the overstory with at least 25% cover ..... Group B

2. Not as above ..... 3.

3. Other shrubs dominate the overstory with at least 25% cover ..... Group C

3. Not as above ..... 4.

4. Community dominated by herbaceous species ..... Group D

Group A. Aspen and Cottonwood dominated types

1. *Populus tremuloides* dominates the overstory ..... 2.

1. *Populus balsamifera ssp. trichocarpa* dominates the overstory (not sampled)

2. *Salix* species with at least 10% cover

. . . . . ***Populus tremuloides/Salix* c.t.**

2. Not as above . . . . . 3.

3. *Rosa woodsii* at least 25% cover . . . . . ***Populus tremuloides/Rosa woodsii* c.t.**

3. Not as above . . . . . 4.

4. *Alnus incana* at least 10% cover . . . . . ***Populus tremuloides/Alnus incana* c.t.**

4. Not as above . . . . . 5.

5. *Symphoricarpos spp.* at least 25% cover

. . . . . ***Populus tremuloides/Symphoricarpos spp.* c.t.**

5. Not as above . . . . . 6.

6. *Ribes spp.* at least 25% cover . . . . . ***Populus tremuloides/ Ribes spp.* c.t.**

6. Not as above . . . . . 7.

7. *Poa pratensis* at least 15% cover and dominating the herbaceous layer

. . . . . ***Populus tremuloides/Poa pratensis* c.t.**

7. Not as above . . . . . 8.

8. *Carex lanuginosa* at least 20% cover

. . . . . ***Populus tremuloides/Carex lanuginosa* c.t.**

8. Not as above . . . . . 9.

9. *Osmorhiza spp.* at least 15% cover

. . . . . ***Populus tremuloides/Osmorhiza spp.* c.t.**

9. *Elymus glaucus* at least 15% cover

. . . . . ***Populus tremuloides/Elymus glaucus* c.t.**

Group B. Willow Dominated Community Types

1. *Salix exigua* dominates the overstory . . . . . 10.

1. Not as above, other willow species dominate the overstory . . . . . 2.

2. *Salix lutea* dominates the overstory. . . . . 17.

2. Not as above, other willow species dominate the overstory . . . . . 3.

3. *Salix lasiolepis* dominates the overstory . . . . . 19.

3. Not as above, other willow species dominate the overstory . . . . . 4.

4. *Salix lemmonii* dominates the overstory . . . . . 20.

4. Not as above, other willow species dominate the overstory ..... 5.

5. *Salix geyeriana* dominates the overstory ..... 27.

5. Not as above, other willow species dominate the overstory ..... 6.

6. *Salix boothii* dominates the overstory ..... 37.

6. Not as above, other willow species dominate the overstory ..... 7.

7. *Salix lucida* dominates the overstory ..... 41.

7. Not as above, other willow species dominate the overstory ..... 8.

8. *Salix eastwoodiae* dominates the overstory ..... 42.

8. Not as above, other willow species dominate the overstory ..... 9.

9. *Salix orestra* dominates the overstory ..... 45.

9. *Salix planifolia* dominates the overstory ..... 46.

10. *Poa pratensis* dominates the understory ..... ***Salix exigua/Poa pratensis* c.t.**

10. Not as above ..... 11.

11. *Agrostis scabra* dominates the understory ..... ***Salix exigua/Agrostis scabra* c.t.**

11. Not as above ..... 12.

12. *Juncus balticus* dominates the understory ..... ***Salix exigua/Juncus balticus* c.t.**

12. Not as above ..... 13.

13. *Muhlenbergia richardsonis* dominates the understory .....
..... ***Salix exigua/Muhlenbergia richardsonis* c.t.**

13. Not as above ..... 14.

14. *Leymus triticoides* dominates the understory .....
..... ***Salix exigua/Leymus triticoides* c.t.**

14. Not as above ..... 15.

15. *Equisetum arvense* dominates the understory

..... ***Salix exigua/Equisetum arvense* c.t.**

15. Not as above ..... 16.

16. *Trifolium wormkioldii* dominates the understory

..... ***Salix exigua/Trifolium wormskioldii* c.t.**

16. Gravel bar communities with sparse understory ..... ***Salix exigua*/Gravel bar c.t.**

17. *Poa pratensis* dominates the understory ..... ***Salix lutea/Poa pratensis* c.t.**

17. Not as above 18

18. *Carex nebrascensis* dominates the understory

..... ***Salix lutea/Carex nebrascensis* c.t.**

18. *Equisetum arvense* dominates the understory

..... ***Salix lutea /Equisetum arvense* c.t.**

19. *Poa pratensis* dominates the understory ..... ***Salix lasiolepis/Poa pratensis* c.t.**

19. *Artemisia ludoviciana* dominates the understory

..... ***Salix lasiolepis/Artemisia ludoviciana* c.t.**

20. *Agrostis scabra* dominates the understory.

..... ***Salix lemmonii/Agrostis scabra* c.t.**

20. Not as above. ..... 21.

21. *Calamagrostis canadensis* dominates the understory.

..... ***Salix lemmonii/Calamagrostis canadensis* c.t.**

21. Not as above ..... 22.

22. *Poa pratensis* dominates the understory..... ***Salix lemmonii/Poa pratensis* c.t.**

22. Not as above. ..... 23.

23. *Carex lanuginosa* dominates the understory.

..... ***Salix lemmonii/Carex lanuginosa* c.t.**

23. Not as above. ..... 24.

24. *Carex scopulorum* dominates the understory.

..... ***Salix lemmonii/Carex scopulorum* c.t.**

24. Not as above. ..... 25.

25. *Glyceria elata* dominates the understory.

..... ***Salix lemmonii/Glyceria elata* c.t.**

25. Not as above. ..... 26.

26. *Ligusticum grayii* dominates the understory.

..... ***Salix lemmonii/Ligusticum grayii* c.t.**

26. *Trifolium monanthum* dominates the understory

..... ***Salix lemmonii/Trifolium monanthum* c.t.**

27. *Poa pratensis* dominates the understory..... ***Salix geyeriana/Poa pratensis* c.t.**

27. Not as above. ..... 28.

28. *Juncus balticus* dominates the understory.

..... ***Salix geyeriana/Juncus balticus* c.t.**

28. Not as above. ..... 29.

29. *Glyceria elata* dominates the understory.

..... ***Salix geyeriana/Glyceria elata* c.t.**

29. Not as above. ..... 30.

30. *Calamagrostis canadensis* dominates the understory.

..... ***Salix geyeriana/Calamagrostis canadensis* c.t.**

30. Not as above. ..... 31.

31. *Agrostis stolonifera* dominates the understory.

..... ***Salix geyeriana/Agrostis stolonifera* c.t.**

31. Not as above. ..... 32.

32. *Carex nebrascensis* dominates the understory.

..... ***Salix geyeriana/Carex nebrascensis* c.t.**

32. Not as above. ..... 33.

33. *Carex scopulorum* dominates the understory.

..... ***Salix geyeriana/Carex scopulorum* c.t.**

33. Not as above. ..... 34.

34. *Carex simulata* dominates the understory.

..... ***Salix geyeriana/Carex simulata* c.t.**

34. Not as above. ..... 35.

35. *Thalictrum sparsiflorum* dominates the understory.

..... ***Salix geyeriana/Thalictrum sparsiflorum* c.t.**

35. Not as above. ..... 36.

36. *Trifolium monanthum* dominates the understory.

..... ***Salix geyeriana/Trifolium monanthum* c.t.**

36. T*rifolium wormskioldii* dominates the understory.

..... ***Salix geyeriana/Trifoliium wormskioldii* c.t.**

37. *Poa pratensis* dominates the understory..... ***Salix boothii/Poa pratensis* c.t.**

37. Not as above. ..... 38.

38. *Carex microptera* dominates the understory.

..... ***Salix boothii/Carex microptera* c.t.**

38. Not as above ..... 39.

39. *Carex nebrascensis* dominates the understory.

..... ***Salix boothii/Carex nebrascensis* c.t.**

39. Not as above 40

40. *Carex microptera* dominates the understory.

..... ***Salix boothii/Carex nebrascensis* c.t.**

40. *Trifolium monanthum* dominates the understory.

..... ***Salix boothii/Trifolium monanthum* c.t.**

41. *Poa pratensis* dominates the understory.

..... ***Salix lucida ssp. lasiandra/Poa pratensis* c.t.**

41. *Juncus balticus* dominates the understory.

..... ***Salix lucida ssp. lasiandra/Juncus balticus* c.t.**

42. *Poa pratensis* dominates the understory.

..... ***Salix eastwoodiae/Poa pratensis* c.t.**

42. Not as above. ..... 43.

43. *Carex scopulorum* dominates the understory.

..... ***Salix eastwoodiae/Carex scopulorum* c.t.**

43. Not as above. ..... 44.

44. *Carex simulata* dominates the understory.

..... ***Salix eastwoodiae/Carex simulata* c.t.**

44. *Aster alpigenus* dominates the understory.

..... ***Salix eastwoodiae/Aster alpigenus* c.t.**

45. *Poa pratensis* dominates the understory..... ***Salix orestera/Poa pratensis* c.t.**

45. *Carex scopulorum* dominates the understory.

..... ***Salix orestera/Carex scopulorum*** **c.t.**

46. *Carex nebrascensis* dominates the understory.

..... ***Salix planifolia/Carex nebrascensis*** **c.t.**

46. *Aster breweri* dominates the understory. ..... ***Salix planifolia/Aster breweri*** **c.t.**

Group C. Nonwillow Shrub dominated Types

1. *Alnus incana ssp. tenuifolia* dominates the shrub layer. ..... 5.

1. Not as above. ..... 2.

2. *Artemisia cana* dominates the shrub layer. ..... 6.

2. Not as above. ..... 3.

3. *Ribes inerme* dominates the shrub layer. ..... 16.

3. Not as above. ..... 4.

4. *Rosa woodsii* dominates the shrub layer. ..... 17.

4. *Vaccinium nivictum* dominates the shrub layer. ..... 18.

5. *Poa pratensis* dominates the understory.

..... ***Alnus incana ssp. tenuifolia/Poa pratensis*** **c.t.**

5. *Poa wheeleri* dominates the understory.

..... ***Alnus incana ssp. tenuifolia/Poa wheeleri*** **c.t.**

6. *Poa pratensis* dominates the understory. ..... ***Artemisia cana/Poa pratensis*** **c.t.**

6. Not as above. ..... 53.

7. *Poa cusickii* dominates the understory. ..... ***Artemisia cana/Poa cusickii*** **c.t.**

7. Not as above. ..... 54.

8. *Phleum pratense* dominates the understory.

..... ***Artemisia cana/Phleum pratense*** **c.t.**

8. Not as above. ..... 9.

9. *Poa secunda ssp. juncifolia* dominates the understory.

..... ***Artemisia cana/Poa secunda ssp. juncifolia*** **c.t.**

9. Not as above ..... 10.

10. *Carex douglasii* dominates the understory.

..... ***Artemisia cana/Carex douglasii* c.t.**

10. Not as above. ..... 11.

11. *Carex praegracilis* dominates the understory.

..... ***Artemisia cana/Carex praegracilis* c.t.**

11. Not as above. ..... 12.

12. *Juncus balticus* dominates the understory.

..... ***Artemisia cana/Juncus balticus* c.t.**

12. Not as above. ..... 13.

13. *Juncus covillei ssp. obtusatus* dominates the understory.

..... ***Artemisia cana/Juncus covillei ssp. obtusatus* c.t.**

13. Not as above. ..... 14.

14. *Juncus orthophyllus* dominates the understory.

..... ***Artemisia cana/Juncus orthophyllus* c.t.**

14. Not as above. ..... 15.

15. *Arnica chamissonis ssp. foliosa* dominates the understory.

..... ***Artemisia cana/Arnica chamissonis ssp. foliosa* c.t.**

15. *Iris missouriensis* dominates the understory.

..... ***Artemisia cana/Iris missouriensis* c.t.**

16. *Carex lanuginosa* dominates the understory.

..... ***Ribes inerme/Carex lanuginosa* c.t.**

16. *Arnica chamissonis ssp. foliosa* dominates the understory.

..... ***Ribes inerme/Arnica chamissonis ssp. foliosa* c.t.**

17. *Poa pratensis* dominates the understory. ..... ***Rosa woodsii/Poa pratensis* c.t.**

17. *Smilacina stellata* dominates the understory.

..... ***Rosa woodsii/Smilacina stellata* c.t.**

18. *Carex subnigricans* dominates the understory.

..... ***Vaccinium nivictum/Carex subnigricans* c.t.**

18. *Carex scopulorum* dominates the understory.

..... ***Vaccinium nivictum/Carex scopulorum* c.t.**

Group D. Herbaceous dominated types

1. Sites dominated by forbs. 5
1. Not as above, sites dominated by grasses or grasslikes. . . . . 2.
2. Sites dominated by *Eleocharis pauciflora.* . . . . . ***Eleocharis pauciflora* c.t.**
2. Not as above. . . . . 3.
3. Sites dominated by *Juncus* spp. . . . . 11.
3. Not as above. . . . . 4.
4. Sites dominated by *Carex* spp. . . . . 13.
4. Sites dominated by true grasses (*Poa, Deschampsia, Agrostis* or *Festuca* spp.).
. . . . . 23.
5. *Iris missouriensis* dominates the herbaceous layer. . . . . ***Iris missouriensis* c.t.**
5. Not as above. . . . . 6.
6. *Veratrum californicum var. californicum* dominates the herbaceous layer.
. . . . . ***Veratrum californicum var. californicum* c.t.**
6. Not as above. . . . . 7.
7. *Arnica chamissonis ssp. chamissonis* dominates the herbaceous layer.
. . . . . ***Arnica chamissonis ssp. chamissonis* c.t.**
7. Not as above. . . . . 8.
8. *Polygonum bistortoides* dominates the herbaceous layer.
. . . . . ***Polygonum bistortoides* c.t.**
8. Not as above. . . . . 9.
9. *Trifolium longipes* dominates the herbaceous layer. . . . . ***Trfolium longipes* c.t.**
9. Not as above. . . . . 10.
10. *Trifolium monanthum* dominates the herbaceous layer.
. . . . . ***Trifolium monanthum* c.t.**
10. *Aster alpigenus* dominates the herbaceous layer. . . . . ***Aster alpigenus* c.t.**
11. *Juncus balticus* dominates the herbaceous layer. . . . . ***Juncus balticus* c.t.**
11. Not as above. . . . . 12.

12. *Juncus nevadensis* dominates the herbaceous layer. ..... ***Juncus nevadensis* c.t.**

12. *Juncus orthophyllus* dominates the herbaceous layer.

..... ***Juncus othophyllus* c.t.**

13. *Carex athrostachya* dominates the herbaceous layer.

..... ***Carex athrostachya* c.t.**

13. Not as above. ..... 14.

14. *Carex douglasii* dominates the herbaceous layer. ..... ***Carex douglasii* c.t.**

14. Not as above. ..... 15.

15. *Carex filifolia* dominates the herbaceous layer..... ***Carex filifolia* c.t.**

15. Not as above. ..... 16.

16. *Carex microptera* dominates the herbaceous layer..... ***Carex microptera* c.t.**

16. Not as above. ..... 17.

17. *Carex nebrascensis* dominates the herbaceous layer.

..... ***Carex nebrascensis* c.t.**

17. Not as above. ..... 18.

18. *Carex praegracilis* dominates the herbaceous layer. ..... ***Carex praegracilis* c.t.**

18. Not as above. ..... 19.

19. *Carex scopulorum* dominates the herbaceous layer. ..... ***Carex scopulorum* c.t.**

19. Not as above. ..... 20.

20. *Carex simulata* dominates the herbaceous layer..... ***Carex simulata* c.t.**

20. Not as above. ..... 21.

21. *Carex subnigricans* dominates the herbaceous layer.

..... ***Carex subnigricans* c.t.**

21. Not as above. ..... 22.

22. *Carex utriculata* dominates the herbaceous layer..... ***Carex utriculata* c.t.**

22 *Carex vesicaria* dominates the herbaceous layer..... ***Carex vesicaria* c.t.**

23. *Agrostis stolonifera* dominates the herbaceous layer..... **Agrostis *stolonifera* c.t.**

23. Not as above. ..... 24.

24. *Danthonia californica* dominates the herbaceous layer.

..... ***Danthonia californica*** **c.t.**

24. Not as above. ..... 25.

25. *Deschampsia cespitosa* dominates the herbaceous layer.

..... ***Deschampsia cespitosa*** **c.t.**

25. Not as above ..... 26.

26. *Deschampsia elongata* dominates the herbaceous layer.

..... ***Deschampsia elongata*** **c.t.**

26. Not as above. ..... 27.

27. *Festuca rubra* dominates the herbaceous layer..... ***Festuca rubra*** **c.t.**

27. Not as above. ..... 28.

28. *Hordeum brachyantherum* dominates the herbaceous layer.

..... ***Hordeum brachyantherum*** **c.t.**

28. Not as above. 29

29. *Muhlenbergia richardsonis* dominates the herbaceous layer.

..... ***Muhlenberiga richardsonis*** **c.t.**

29. Not as above. ..... 30.

30. *Poa bulbosa* dominates the herbaceous layer. ..... ***Poa bulbosa*** **c.t.**

30. Not as above. ..... 31.

31. *Poa cusickii ssp. cusickii* dominates the herbaceous layer.

..... ***Poa cusickii ssp. cusickii*** **c.t.**

31. Not as above. ..... 32.

32. *Poa cusickii ssp. epilis* dominates the herbaceous layer.

..... ***Poa cusickii ssp. epilis*** **c.t.**

32. Not as above. ..... 33.

33. *Poa pratensis ssp. pratensis* dominates the herbaceous layer.

..... ***Poa pratensis ssp. pratensis*** **c.t.**

33. Not as above. ..... 34.

34. *Poa pratensis ssp. agassizensis* dominates the herbaceous layer.

..... ***Poa pratensis ssp. agassizensis*** **c.t.**

34. *Poa secunda ssp. juncifolia* dominates the herbaceous layer.

..... ***Poa secunda ssp. juncifolia*** **c.t.**

Determining Ecological Status

Once you have identified the ecological type, you are ready to determine the ecological status of the site using both vegetation and soil measurements. Enter measured values in the appropriate vegetation and soil tally sheets for the type you are in, then use the scorecard to determine ecological status.

Vegetation Tally Sheet

The similarity of vegetation to the PNC is determined using rooted frequency of occurrence of plant species in a quadrat frame. Rooted frequency was chosen instead of canopy cover because it decreased the error between observers. Within the homogeneous site, use three transects, each 20m long, for recording frequency of occurrence of plant species. For narrow riparian areas next to a stream channel, place the transects end-to-end. For larger areas, place the three transects parallel to each other with the transects 5 to 10 meters apart. Some analysis packages allow for only 10 frames in a transect. In that case, six transects would be necessary to get the required 60 frames. Place the transects to best represent the area being sampled. Stay within the boundaries of one ecological type. The size of the quadrat frame used depends on the ecological type. The appropriate frame size is printed on each vegetation tally sheet.

Ecological type	Size
Dry graminoid -- Typic Haplocryoll -- Trough drainageway	10cm X 10cm
Poa cusickii ssp. epilis -- Aquic Haplocryoll -- Trough drainageway and Floodplain	10cm X 10cm
Carex scopulorum -- Oxyaquic Cryochrept -- Trough drainageway	10cm X 10cm
Carex utriculata -- Oxyaquic Haplocryoll -- Floodplain	10cm X 10cm
Carex nebrascensis -- Typic Cryaquoll -- Drainageway	10cm X 10cm
Mesic graminoid -- Oxyaquic Haplocryoll -- Drainageway	10cm X 10cm
Salix eastwoodiae -- Cryaquoll -- Floodplain	**20cm X 20cm**
Warm willow -- Typic Cryaquent -- Floodplain	**20cm X 20cm**
Cold willow/Mesic graminoid -- Cryaquoll -- Floodplain	**20cm X 20cm**
Pinus contorta ssp. murrayana/Mesic graminoid -- Haplocryoll -- Stream terrace and Floodplain	**20cm X 20cm**
Artemisia cana/Mesic graminoid -- Pachic Haplocryoll -- Drainageway	20cm X 50cm
Warm willow -- Oxyaquic Cryorthent -- Gravel bar	20cm X 50cm
Cold willow/Mesic forb -- Haplocryoll -- Floodplain	no scorecard
Populus tremuloides/Mesic graminoid -- Haplocryoll -- Floodplain and Stream terrace	20cm X 50cm
Populus tremuloides/Tall forb -- Cumulic Haplocryoll -- Trough floodplain	20cm X 50cm
Pinus contorta ssp. murrayana/Salix spp. -- Cryaquoll -- Floodplain	20cm X 50cm

Once the appropriate frame size is chosen, place the quadrat at 1m intervals along the transect. This will give 20 quadrats for each transect or a total of 60 quadrats for the three transects (or six transects if only 10 quadrats are placed on one transect). You will need a separate tally sheet for each transect.

Sixty quadrats per plot will give a statistical level of precision of plus or minus 15 percent at a confidence level of 80 percent for the most common species on a site. To detect a 10 percent change at a confidence level of 80 percent, 100 quadrats need to be sampled. This sampling intensity may be appropriate on a site that will be used to monitor trend over time.

For each quadrat, record a tally for each listed plant species rooted in the frame. A species gets tallied only if it is rooted within the frame. Only those species listed on the tally sheet need be recorded. If desired, a complete species list may be recorded, using Appendix G. to assign each species to its indicator group. After completing the three transects sum up the "hits" for each species, for each species indicator group and for all transects. Calculate the relative frequencies for each of the three species indicator groups: (1) species indicating high similarity to PNC; (2) species indicating moderate similarity to PNC; and (3) species indicating low similarity to PNC. The three relative frequencies should add to 100 percent.

Use the Vegetation Similarity to PNC triangle for the same ecological type to calculate the vegetation score. Locate the relative frequency of species indicating high similarity to PNC on the vertical axis and the relative frequency of species indicating low similarity to PNC on the horizontal axis. Mark the intersection of these two values and note the appropriate vegetation similarity class in the Scorecard below.

Environmental Features Tally Sheet

The scorecard values portion of the tally sheet will guide you to measure only those environmental features that vary significantly with ecological status. Measure the appropriate features using the following instructions and enter your findings on the Tally Sheet.

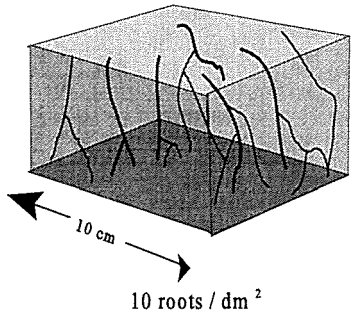
The mapping values portion of the tally sheet supplies additional data that are helpful in correlating ecological types, but which are not used in determining ecological status directly. For correlation, the soil needs to be classified to the family level, requiring close to a full soil pedon description. If the soil is in the aquic moisture regime or if the site is in an ecological type typified by aquic soils, notes on redoximorphic features and other indicators of hydric soils should be made. Landform and taxa should be compared with the classes given in the ecological type name to see whether they match.

Rooting Depth and Abundance

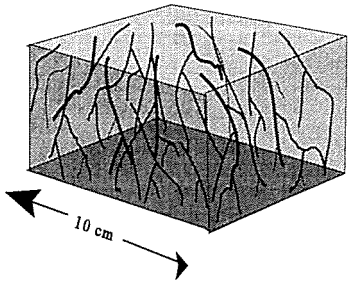
Roots of perennial grasses and herbs in the eastern Sierra Nevada region have distinct distribution patterns in relation to condition. Grasses and grass-likes have fibrous roots whose depth and density are dependent on site conditions. Rooting depth is based on the fine and very fine size roots typical of grasses and grass-like plants.

Abundance values of fine (1-2mm diameter) and very fine (<1mm diameter) roots range from few to many within a square decimeter on the pit wall: few(1) = less than 10 roots, common (2) = 10-100 roots, many (3) = more than 100 roots (USDA, Soil Conservation Service, 1975), (Figure 1). A square decimeter is approximately a palm sized area.

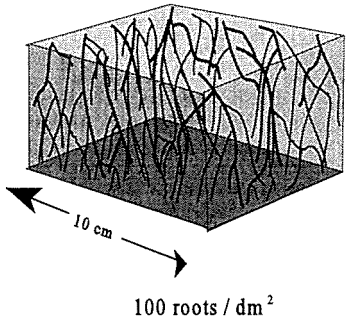
Figure 1. Root Density Guide (fine and very fine roots)



10 roots / dm^2



50 roots / dm^2



100 roots / dm^2

Rooting depth marks the depth where the abundance of fine or very fine roots drops below ten per square decimeter. We found that the zone of abundant fine and very fine roots (sod layer) often has a distinct lower boundary. Generally, fine root abundance declines from many (3) or common (2) in the surface layers to few (1) in the subsoil.

Measure rooting depth at a minimum of 10 points distributed along the vegetation transects, using auger-hole samples. Compare the average rooting depth with the ranges for the ecological status groups on the scorecard. Note rooting depth to the right of the class that it fits on the scorecard.

Infiltration

The double cylinder infiltration field method is outlined in Agronomy Monograph 9, Methods of Soil Analysis Part 1, 1965 by American Society of Agronomy and American Society for Testing and Material (ASTM) and in Range Research: Basic Problem and Techniques, 1986 by Society for Range Management. Research has found that a single cylinder is preferable if water flow is vertical. By checking the wetting front next to the cylinder, we found flow on our sites to be vertical and a single cylinder appropriate. Another advantage is that a single cylinder test requires less water. For ease of calculations, a $0.1m^2$ area cylinder was selected. The cylinder (ring) is 35.6cm (14 inches) in diameter. These cylinders are large enough to avoid edge effects from pounding them in (Gifford, G.F., per com., 1990) yet small enough to be portable. Depth of cylinder insertion and steady depth of water ponding are important factors to keep consistent among tests.

Both moisture and slope limit the application of this test. Wet and saturated sites are too wet to be tested. Sites with surface soil that feels warm and dry (1) or cool (2) should test well. Sites that are moist to the touch (3) may not reflect true infiltration capability of the site. Slopes greater than 35% are too steep because they affect pond depth and direction of water flow in the soil.

Three replicates are run simultaneously to test a site. Four or more sets should be used on complex micro-topography with cylinders centered on any microtopographic features that may exist. As a practical matter, at fast infiltration sites (greater than 5,000 ml in 5 minutes) run only one test.

Set up and pre-wet site. Prune woody branches that obstruct cylinder placement. Hammer cylinders into earth. For consistency install 3cm deep to gain firm earth contact. Install cylinder top parallel with the surrounding land surface. Note microtopography such as coppice dune (c) or hummocks (h) as listed on infiltration form. Coppice dunes are mounds of windblown soil and litter under shrubs. The areas between the dunes are called the interspaces (i). Hummocks occur in wet meadows due to trampling. In extreme cases there may be a 25cm displacement between the top of the hummocks and the bottom of the channel-ways between them. None (n) applies to more or less flat ground or smooth hillsides. The percent of the ground surface within the cylinder covered by vegetation (aerial), litter, moss and cryptogams is recorded as percent residue cover. Pour 2,500 ml of water uniformly within each cylinder for consistent antecedent soil moisture. Let cylinders drain, overnight if possible.

For the actual infiltration test, about 3 gallons are needed for a set of 3 cylinders. After cylinders are hammered 3cm into earth, place 2.5cm (1 inch) pins within the cylinder. On hillslopes, place the pin 1/3 of the way from the uphill edge of cylinder to the bottom edge. Fill the cylinder to about 2.5cm head at the the start of the test and maintain head through the test. Check for water leaking out from the cylinder. If leaks are found, correct the problem before restarting the test.

Time the test by first setting a stopwatch to 0, then pouring water to the top of the 2.5cm measuring pin in the first inner cylinder, then starting the stopwatch. Use a graduated (1000ml) cylinder to maintain the water level at the pin tip. At 7.5 minutes, record the amount of water used. After the initial 7.5 minutes the test intervals are 5 minutes. In 30 minutes there will be 5 intervals (times are noted on the form). Continue to maintain the 2.5cm head with measured quantities of water. At each test interval record the amount of water absorbed (replaced) in that 5 minute time period.

For the other two cylinders, start the second cylinder one minute after the first cylinder and the third cylinder at two minutes. When one person is running the test alone, or on sites with rapid absorption, longer intervals may be appropriate. Make sure to adjust times on your form. Assuming a one minute delay between cylinders, at 8.5 minutes, record the volume of water used to maintain head in the second inner cylinder and at 9.5 minutes repeat with the third inner cylinder. Follow with 5 minute time intervals.

Calculate average infiltration in ml over 5 minute interval. Sum the volume absorbed over the last 5 intervals and divide by 5 to get an average rate in ml/5min. Compare rates with the range of values for the ecological status groups on the appropriate scorecard.

Comparison to Precipitation Rate and Groundwater Flows

Water flows into and though a soil are often compared to precipitation rates or groundwater flow rates. Precipitation rates are often given as a depth of water per unit time; e.g. cm/hr. Our ponded infiltration test was in a cylinder with a 1,000cm^2 area. A milliliter (ml) equals 1cm^3. The ml/5min value from the test can be divided by 1,000 to give cm/5min. The result is then multiplied by 12 (5min X 12 = 60min) to get a cm/hour value. For an example a Dry Graminoid ecological site in high ecological status may have an average infiltration rate of 3600ml/5min.

$$\frac{3600ml}{5\ min} \cdot \frac{60min}{1\ hr} \cdot \frac{cm^3}{ml} \cdot \frac{1}{1000cm^2} = 43.2cm/hr$$

A compacted site in the same ecological type may only have an average infiltration value of 570ml/5min. This would translate to the the capability of absorbing precipication from only a 6.8cm/hr rainfall event.

For application in erosion technology or for comparison among geologic formations, the saturated hydraulic conductivity (ksat) is used. The ponded head (2.5cm, in the infiltration test) is accounted for using Darcy's Relationship. Factors in the Relationship are flow=Q (in ml/sec or cm^3/sec), area=A (in cm^2), ponded head=i (in 2.5cm/cm^2) and k saturation=ksat (in cm/sec).

(1) $Q = ksat \cdot i \cdot A$

(2) $ksat = Q / i \cdot A$

The Dry Graminoid ecological type has an average grain size of 370 microns in the surface soil. This particle size corresponds to a sand and the expected ksat is $1x10^{-3}$ cm/sec (Freeze and Cherry, 1979). Infiltration rate on a site in high ecological status is 3600ml/5min.

$$ksat = \frac{3600cm3}{5min} \cdot \frac{1cm}{2.5cm} \cdot \frac{1}{1000cm^2} \cdot \frac{5min}{300sec}$$

$ksat = 4.8cm/sec \times 10^{-3}$

This value is comparable to that for clean sand. In contrast, a compacted site may have an average infiltration rate of 570ml/5min which is equal to a ksat of 0.8cm/sec x 10^{-3}. This compares more closely to the 1 x 10^{-4} value for silty sand (Freeze and Cherry, 1979). Condition can have an effect equal to or greater than soil particle size.

INFIL_TEST: Infiltration
Plot Name Date Recorders

Plot Code

Test 1. Site Moisture _____ Microtopography ____

Residual Cover _____% Species 1 _____ Species 2 _____

Initial Fill	Start Value	10 min Value	15 min Value	20 min Value	25 min Value	30 min Value
0:00	7:30	12:30	17:30	22:30	27:30	32:30
	_____ml	_____ml	_____ml	_____ml	_____ml	_____ml

Test 2. Site Moisture _____ Microtopography ____

Residual Cover _____% Species 1 _____ Species 2 _____

Initial Fill	Start Value	10 min Value	15 min Value	20 min Value	25 min Value	30 min Value
0:00	7:30	12:30	17:30	22:30	27:30	32:30
	_____ml	_____ml	_____ml	_____ml	_____ml	_____ml

Test 3. Site Moisture _____ Microtopography ____

Residual Cover _____% Species 1 _____ Species 2 _____

Initial Fill	Start Value	10 min Value	15 min Value	20 min Value	25 min Value	30 min Value
0:00	7:30	12:30	17:30	22:30	27:30	32:30
	_____ml	_____ml	_____ml	_____ml	_____ml	_____ml

Soil Moisture Scale by Touch:

1 = Warm dry; 2 = Cool dry; 3 = Moist; 4 = Wet; 5 = Wet sponge

Microtopography Features:

Coppice Dune = c, Interspace = i (space between coppice dunes) ; Desert pavement = p (gravel up to 3"), Hummocks = h, or None = n (if no feature present)

Residue Cover:

Percent of ground covered by standing live and down organic material within small cylinder.

Species 1 and 2:

Plant Species Alpha Code: Species with 1st and 2nd highest % basal cover within small cylinder or note if litter.

Litter, Basal Vegetation, Soil Cover

Ground cover categories are 1) vegetation basal cover, 2) litter, 3) bare soil, 4) gravel (<3/4 inch in diameter), 5) rock (>3/4 inch in diameter) and 6) cryptogam (including mosses and lichens). A 200 point sample (measured on a drop point frame or on the corners of the frequency frame) spread across the site is used to determine percent cover.

Color value of A horizon

Important soil properties are often associated with colors. Color value of the surface layer, for example, may be used to estimate relative organic matter content. Mollisols have dark value surface horizons and have high nutrient content associated with organic matter.

Soil color is measured by comparison with a Munsell color chart. The Munsell color system uses three elements of color: hue, value and chroma. Hue identifies the spectreal quality of color based on five principle hues: red, yellow, green, blue and purple. Value indicates the degree of lightness or darkness of a color in relation to a neutral grey scale extending from pure black (0) to white (10). Chroma is the richness of the color or degree of dilution of a color by neutral gray of the same value. Chroma extends from 0 for neutral colors to 8 for "vibrant" colors.

Colors are identified on both moist and air dry soils. Bright sunlight is the ideal for distinguishing among the color chips. Color is generally measured on an undisturbed clod surface.

Soil Structure

Soil peds are structural units composed of adhesive organic material attached to sand, silt and clay grains (Soil Survey Division Staff, 1993). A **granular structure** has small round peds that generally occur in surface soil layers. A granualr soil structure's aroma and it's thickness are indicators of biological function familiar to gardeners and aboriginal peoples. With compression (compaction) the peds will reform into thin, flat units (**platy structure**) which limits plant growth and water flow.

Using the Scorecards

Determine ecological status by using the appropriate scorecard, vegetation and soil tally sheets. Compare the vegetation similarity to Potential Natural Community from the vegetation tally sheet with that on the scorecard. Mark the appropriate ecological status class in the "Notes" section on the right side of the scorecard. Likewise, mark the appropriate ecological status class from each soil measure in the "Notes" section on the scorecard. Do this by recording the actual values in the appropriate box in this section. If vegetation and soil class agree, then circle the ecological status in the box at the left of the form. If the vegetation and soil data disagree, select the ecological status class indicated by the preponderance of evidence, or by "averaging".

Determine structural diversity for sites with woody species. At this point we have not determined how closely correlated structural diversity is with ecological status. As a result structural diversity is not considered as a factor in determining ecological status. There is no doubt however, that structural diversity is highly correlated with resource values for wildlife and visual resources. For developing resource value ratings it is helpful to record information on the age class and structural diversity of the woody species. Additional information such as average height (m) for each age class, basal area (m^2) for each age class, crown ratios, and absolute density per hectare for each age class is also helpful.

ECOLOGICAL TYPE DESCRIPTIONS AND SCORECARDS

***Artemisia cana*/Mesic graminoid -- Pachic Haplocryoll-- Drainageway ecological type**

SILVER SAGEBRUSH/MESIC GRAMINOID ECOLOGICAL TYPE

Sample size = 18 plots

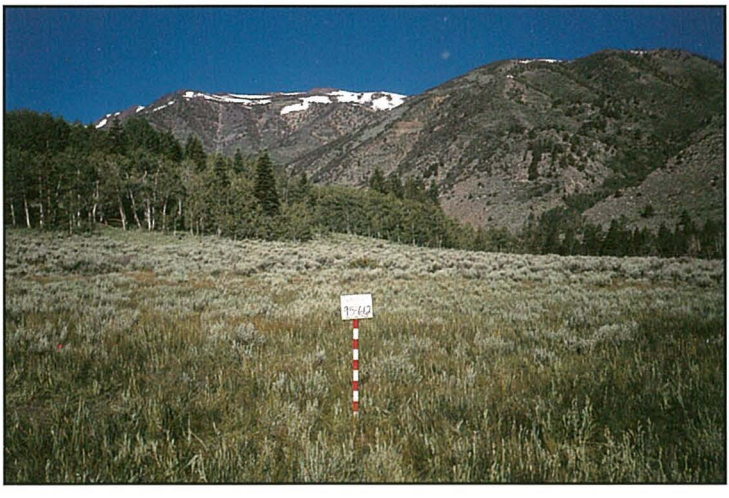


Photo - Plot 95612, Buckeye Creek

Landform and Setting

Generally found in drainageways with shallow lateral slopes. Average lateral slope was 2% and ranged from 0 to 6%. Elevation ranges from 6600 to 9120 ft. Average soil temperature in summer at 50cm is 12 °C. Soils are moist but generally not saturated during the growing season. Depth to coarse fragments is intermediate between willow systems which have coarse fragments near the surface and graminoid meadows where coarse fragments are deep and variable. Depth to 35% coarse fragments averages 59cm $\pm$ 41cm. Average soil surface material grain size is medium sand in texture (D_{50} = 529 microns). Silver sagebrush sites were sampled throughout the Walker river drainage although they are also found in the Carson and Truckee systems.

Description of Ecological Type Dynamics

Potential Natural Community (PNC) - Moderate cover of *Artemisia cana* with an understory of *Poa secunda ssp. juncifolia*, *Elymus trachycaulus ssp. trachycaulus* or *Poa cusickii* and some *Carex spp.* indicates potential vegetation composition for this site. A thin but fairly continuous root mat is important to maintaining this site in good condition.

Disturbance Pathways - Compaction, hoof cutting action or drying of the site may result in loss of vigor in the rooting layer. An indicator of weakened rooting zone conditions is increased cover of any of the taprooted forbs. Cover of *Artemisia cana* will increase with drying of the site or with fire as this species not only sprouts from the base, but also reproduces vegetatively from underground stems (Manning and Padgett, 1995).

Cross References to Other Classifications

ARCA/MG c.t. (Manning and Padgett, 1995) is an example of this ecological type in moderate to high ecological status. More graminoids indicate higher status. More forbs and/or cover of *Artemisia cana* above 40% represent lower ecological status.

ARCA/DG c.t. (Manning and Padgett, 1995) is an example of this ecological type in low ecological status especially when dominated by forbs in the understory. If graminoid cover of *Poa cusickii* and *Elymus trachycaulus ssp. trachycaulus* is high enough this community type could be in moderate ecological status.

ARCA8/COLD c.t. (Smith, 1998 draft) represents this type very closely. Smith's subspecies of *Artemisia cana* is *viscidiflorus* whereas the Sierran subspecies is more likely *ssp. bolanderi.*

ARCA8/DRY c.t. (Smith, 1998 draft) may represent some plots at the lower elevation range of this ecological type, particularly some with lower similarity to PNC. Smith's subspecies of *Artemisia cana* is *viscidiflorus* whereas the Sierran subspecies is more likely *ssp. bolanderi.*

Characteristic Vegetation of the *Artemisia cana*/Mesic graminoid --Pachic Haplocryoll -- Drainageway ecological type

Plant Code	Scientific Name	Percent Constancy	Cover Range	Similarity to PNC
Grasses				
POSEJ	*Poa secunda ssp. juncifolia*	77	1-14	High
MURI	*Muhlenbergia richardsonis*	61	1-5	Moderate
POPR	*Poa pratensis*	44	2-41	Moderate
ELTRT	*Elymus trachycaulus ssp. trachycaulus*	44	1-6	High
LETR5	*Leymus triticoides*	27	1-6	Moderate
POCU3	*Poa cusckii ssp. epilis*	22	1-9	High
AGST2	*Agrostis stolonifera*	22	1-3	Low
ACNED	*Achnatherum nelsonii ssp. dorei*	16	1-3	Moderate
ACOCC	*Achnatherum occidentalis ssp. californica*	16	1-10	Moderate
Grasslikes				
JUBA	*Juncus balticus*	94	1-22	Moderate
CAAT3	*Carex athrostachya*	27	1-11	High
JUOR	*Juncus orthophyllus*	27	1-18	Moderate
JUCOO	*Juncus covillei var. obtusatus*	22	3-15	Moderate
CANE2	*Carex nebrascensis*	22	1-4	High
CASI2	*Carex simulata*	22	1-17	High
CADO2	*Carex douglasii*	22	1-3	Moderate
Forbs				
IRMI	*Iris missouriensis*	66	1-25	Low
PERYO	*Penstemon rydbergii var. oreocharis*	50	1-7	Moderate
ACMI2	*Achillea millefolium*	38	1-3	Low
ASOC	*Aster occidentalis*	38	1-10	Low
ANRO2	*Antennaria rosea*	33	1-9	Low
POGR9	*Potentilla gracilis*	33	1-3	Low
COPA3	*Collinsia parviflora*	27	1-2	Low
TAOF	*Taraxacum officinale*	27	1-6	Low
PEBOB	*Perideridia bolanderi ssp. bolanderi*	22	1	Moderate
DUHO	*Dugaldia hoopesii*	22	2-5	Low
SIOR	*Sidalcea oregana*	22	1-3	Low
PELE5	*Perideridia lemmonii*	16	1-3	Moderate
ARCHF	*Arnica chamissonis foliosa*	16	1-10	Low
POGL9	*Potentilla glandulosa*	16	1-3	Low
MOCH	*Montia chamissoi*	16	1-4	Moderate
TRLO	*Trifolium longipes*	16	1-3	Moderate
Shrubs				
ARCA13	*Artemisia cana*	100	3-35	High

***Artemisia cana*/Mesic graminoid -- Pachic Haplocryoll -- Drainageway**

Location _____

Field Recorders _____

Date _____ Frame Size: 20 X 50 cm

Use Non-Meadow Moist Indicator Values for Any Additional Species

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total
Species Indicating High Similarity to PNC																					
ARCA13																					
POSEJ																					
ELTRT																					
POCU3																					
CAAT3																					
CANE2																					
CASI2																					
Species Indicating Moderate Similarity to PNC																					
JUBA																					
MURI																					
PERYO																					
POPR																					
LETR5																					
JUOR																					
JUCOO																					
CADO2																					
Species Indicating Low Similarity to PNC																					
IRMI																					
ACMI2																					
ASOC																					
ANRO2																					
POGR9																					
COPA3																					
TAOF																					

Environmental Features

Scorecard Values:

Rooting Depth (cm)_____ (many, fine or very fine roots)

Mapping Values:

Soil Taxa _____

Landform _____

Form # 17-2060-32 (9/98)

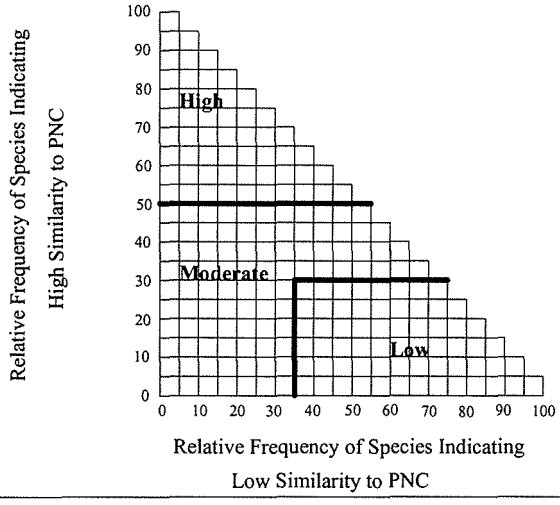
Artemisia cana/Mesic graminoid -- Pachic Haplocryoll -- Drainageway

Location: _____

Scorer: _____

Sample Date: _____

Vegetation similarity to PNC



Scorecard		
Ecological Status	Description	Notes
High Similarity to PNC	Vegetation has high similarity to PNC Rooting depth (many) 11 - 26 cm	
Moderate Similarity to PNC	Vegetation has moderate similarity to PNC Rooting depth (many) 4 - 10 cm	
Low Similarity to PNC	Vegetation has low similarity to PNC Rooting depth (many) 0 - 3 cm	

Dry graminoid -- Typic Haplocryoll -- Trough drainageway ecological type

DRY GRAMINOID ECOLOGICAL TYPE

Sample size = 16 plots

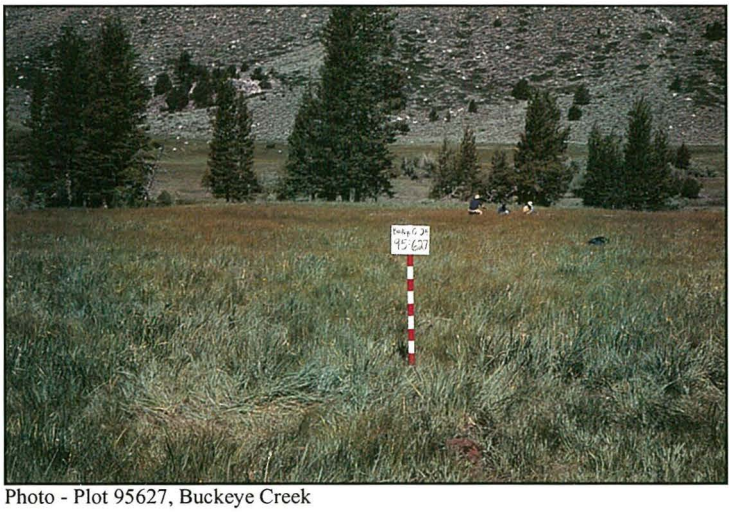


Photo - Plot 95627, Buckeye Creek

Landform and Setting

Most commonly found on trough drainageways (75%) and stream terraces (19%). The drainageways have the trough cross section of an inset alluvial fan. Valley slope tends to be about 3%. Lateral slope averages 2% but ranges up to 4%. Most soils are moist only in the early growing season. Soils lack saturation and redoximorphic features within a meter of the surface. The soils in this type are at field capacity while soils in the adjacent sagebrush dominated landscape are air dry. Elevations range from 6500 to 8400 feet and soil temperature at 50cm depth averages 14 °C. Most (81%) soils have sufficient organic matter accumulation to be classed as Mollisols. The most common soils are Haplocryolls (63%). The dark, mollic surface horizons are generally between 25cm and 40cm thick (Typic); occasionally, they are over 40cm thick (Pachic). Average soil surface material grain size is fine sand in texture (D_{50} = 317 microns). Sampled in the Walker and Carson river drainages .

Description of Ecological Type Dynamics

Potential Natural Community (PNC) - *Poa secunda ssp. juncifolia* in combination with *Poa pratensis, Muhlenbergia richardsonis* and/or *Carex spp.* dominate these sites at PNC. *Carex praegracilis* and *Carex nebrascensis* in particular are indicators of high similarity to PNC. Other indicators of high similarity to PNC which may or may not be present are: *Elymus trachycaulus* and *Carex filifolia*. Rooting depth and infiltration rate are indicators of site health related to the vigor, density and cover of bunchgrasses and rhizomatous species.

Disturbance Pathways - Because of dry soils, sites in this ecological type are vulnerable and easily altered by disturbance. Once altered, they are often slow to recover. Heavy grazing or other soil compacting activities cause a decline in perennial bunchgrasses and

rhizomatous species. Disturbance species such as *Potentilla gracilis, Achillea millefolia, Poa pratensis* and/or *Juncus balticus* are typically present on sites that are heavily grazed and/or compacted (Manning and Padgett, 1995). *Carex douglasii* is an indicator of moderate similarity to PNC. Sites with high cover of this species should be evaluated for ecological function using measures of function such as rooting depth and infiltration rate. Following prolonged disturbance or a drop in the water table, shrubs such as *Artemisia tridentata ssp. tridentata* and *Rosa woodsii* may become established and persist.

Cross References to Other Classifications

PONE2 association (Smith, 1998 draft) is a representative of high similarity to potential in this ecological type.

CADO c.t. (Smith, 1998 draft) is an example of this type with low similarity to PNC. Some *Carex douglasii* cover may be present in sites with high similarity to PNC however. Other measures of function, such as rooting depth and infiltration rate, are needed to assess ecological status of this plant community.

MURI1 c.t. (Smith, 1998 draft) is a community type representing low similarity to PNC in this ecological type or others.

CADO c.t. (Manning and Padgett, 1995) represents moderate similarity to PNC in this ecological type.

IRMI/DG c.t. (Manning and Padgett, 1995) represents low similarity to PNC in this ecological type. *Iris missouriensis* is often an indicator of compaction on a site with higher potential.

Montane meadow habitat (Sawyer and Keeler-Wolf, 1995) where soil moisture conditions fit within the range of this ecological type represent varying levels of similarity to PNC, depending on species composition, rooting depth and infiltration.

Characteristic Vegetation of the Dry Graminoid --Typic Haplocryoll -- Trough drainageway ecological type

Plant Code	Scientific Name	Percent Constancy	Cover Range	Similarity to PNC
Grasses				
POSEJ	*Poa secunda ssp juncifolia*	75	1-60	High
MURI	*Muhlenbergia richardsonis*	62	1-23	Moderate
ELEL5	*Elymus elymoides*	31	1-3	Low
BRTE	*Bromus tectorum*	25	1-3	Low
HOBR2	*Hordeum brachyantherum*	18	1-3	Low
POPR	*Poa pratensis*	18	3-10	High
LETR5	*Leymus triticoides*	18	1-10	Moderate
ACNE10	*Achnatherum nevadensis*	18	1-3	Moderate
AGST2	*Agrostis stolonifera*	12	1	Low
LECI4	*Leymus cinerius*	12	1-3	High
POBU	*Poa bulbosa*	12	60-70	Low
Grasslikes				
CADO2	*Carex douglasii*	75	1-80	Moderate
JUBA	*Juncus balticus*	62	3-19	Moderate
JUCOO	*Juncus covillei var. obtusatus*	12	1-3	Moderate
CANE2	*Carex nebrascensis*	12	1-8	High
Forbs				
PODO4	*Polygonum douglasii*	50	1-3	Low
GADI2	*Gayophytum diffusum*	37	1-3	Low
NABR	*Navarettia breweri*	37	1-3	Low
POPO4	*Polygonum polygaloides*	25	1-3	Low
PERYO	*Penstemon rydbergii var. oreocharis*	25	1	Moderate
COPA3	*Collinsia parviflora*	25	1	Low
IRMI	*Iris missouriensis*	25	1-4	Low
LULE2	*Lupinus lepidus*	25	1-3	Moderate
ACMI2	*Achillea millefolium*	18	1	Low
PLHI7	*Plagiobothrys hispidulus*	18	1	Low
TAOF	*Taraxacum officinale*	18	1	Low
TRMO2	*Trifolium monanthum*	18	1-40	Low
CEBEC	*Cerastium beeringianum var. capillare*	12	3	Low
ALLE3	*Allium lemmonii*	12	1	Moderate
IVAPA	*Ivesia aperta var. aperta*	12	1	Moderate
POGR9	*Potentilla gracilis*	12	2-3	Low
Shrubs				
ARTRT	*Artemisia tridentata ssp. tridentata*	31	1-6	Low
ARCA13	*Artemisia cana*	25	1-3	High
CHNA2	*Chrysothamnus nauseosus*	18	3	Low

Dry Graminoid -- Typic Haplocryoll -- Trough Drainageway

Location _____

Field Recorders _____

Date _____ Frame Size: 10 X 10 cm

Use Dry Meadow Indicator Values for Any Additional Species

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total
Species Indicating High Similarity to PNC																					
POSEJ																					
ARCA13																					
POPR																					
LECI4																					
CANE2																					
Species Indicating Moderate Similarity to PNC																					
CADO2																					
JUBA																					
MURI																					
PERYO																					
LULE2																					
LETR5																					
ACNE10																					
Species Indicating Low Similarity to PNC																					
PODO4																					
GADI2																					
NABR																					
ELEL5																					
ARTRT																					
POPO4																					
BRTE																					
COPA3																					

Environmental Features

Scorecard Values:

Rooting Depth (cm) _____ (common, fine or very fine roots)

Infiltration rate (ml/5min.) _____

Mapping Values:

Soil Taxa _____

Landform _____

Form # 17-2060-34 (9/98)

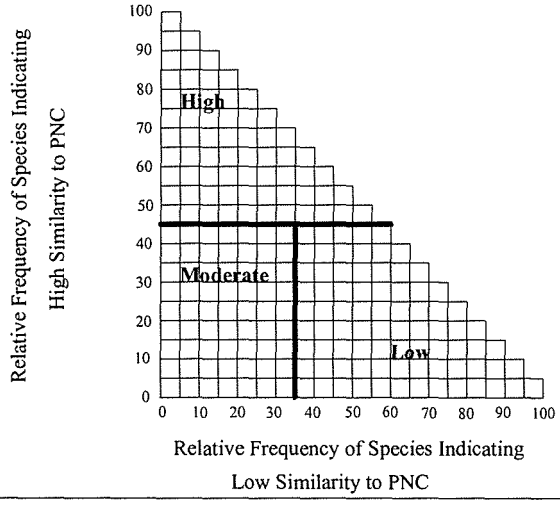
Dry Graminoid -- Typic Haplocryoll -- Trough drainageway

Location: _____

Scorer: _____

Sample Date: _____

Vegetation similarity to PNC



Scorecard		
Ecological Status	Description	Notes
High Similarity to PNC	Vegetation has high similarity to PNC Rooting depth (common) 29 - 73 cm Infiltration rate (ml/5 min.) 2358 - 3670	
Moderate Similarity to PNC	Vegetation has moderate similarity to PNC Rooting depth (common) 12 - 28 cm Infiltration rate (ml/5 min.) 1300 - 2357	
Low Similarity to PNC	Vegetation has low similarity to PNC Rooting depth (common) 0 - 11 cm Infiltration rate (ml/ 5 min.) 0 - 1299	

***Poa cusickii ssp. epilis* -- Aquic Haplocryoll -- Trough drainageway and Floodplain ecological type**

SKYLINE BLUEGRASS ECOLOGICAL TYPE

Sample size = 10 plots

Photo - Plot 96743, Coyote Creek

Landform and Setting

This type is evenly distributed among drainageway and floodplain landforms between 7500 and 9600 feet. Soil temperature is cold during the growing season. Temperature at 50cm depth averages 10 °C. More moist than Dry Graminoid and Silver Sagebrush/Mesic Graminoid types, depth to saturation averages 85cm. Most soils (60%) have both saturation and redoximorphic features with one meter of the surface. The most common soils were Aquic Haplocryolls. Most soils had enough organic matter accumulation to be classed as Mollisols. Surface soil material texture was fine sand (average D_{50} = 259 microns). Coarse material (at least 35% rock fragments) was encountered within the soil profile. Valley slope tends to be about 4%. Lateral slope averages 2% but ranges up to 4%. Sampled in the Walker and Carson river drainages.

Description of Ecological Type Dynamics

Potential Natural Community (PNC) - *Poa cusickii ssp. epilis, Carex athrostachya, Carex microptera, Carex heteroneura, Carex simulata* and/or *Carex nebrascensis* dominate sites that have high similarity to PNC. *Poa cusickii ssp. epilis* is a native grass that appears to take the place of *Poa pratensis* on higher elevation snowbed sites in the eastern Sierra Nevada. Associated species which may be present with low cover are *Trifolium longipes*, *Carex praegracilis*, and *Juncus balticus.*

Disturbance Pathways - This ecological type is vulnerable to disturbance from grazing because it provides high value forage and is prefered by livestock. These sites are particularly susceptible to compaction due to fine textured, moist soils. *Juncus balticus* and/or *Juncus nevadensis* tend to dominate sites with moderate similarity to PNC. Some *Carex nebrascensis* dominated sites also have moderate similartiy to PNC. Disturbance species such as *Iris missouriensis*, *Potentilla gracilis*, and *Achillea millefolium* are typically present on sites that are heavily grazed or compacted (Manning and Padgett, 1995).

Cross References to Other Classifications

Subalpine Meadow Habitat (Sawyer and Keeler-Wolf, 1995) includes this ecological type at all degrees of similarity to PNC.

Montane Meadow Habitat (Sawyer and Keeler-Wolf, 1995) may include the lower elevation examples of this ecological type.

Nebraska Sedge Series (Sawyer and Keeler-Wolf, 1995) may include a few communities in this ecological type.

Nebraska Sedge Class (Ratliff, 1982) may include some communities that are part of this ecological type at moderate similarity to PNC.

Longstalk Clover Class (Ratliff, 1982) is an example of this ecological type or other types at moderate similarity to PNC.

CANE1 c.t. (Smith, 1998 draft) is one possible example of this ecological type with moderate to high similarity to PNC.

JUNE c.t. (Smith, 1998 draft) is an example of this ecological type at low to moderate similarity to PNC.

JUBA c.t. (Smith, 1998 draft) is an example of this ecological type at low to moderate similarity to PNC.

TRLO c.t. (Smith, 1998 draft) is an example of low to moderate similarity to PNC in this or other ecological types.

CANE2 c.t. (Manning and Padgett, 1995) Some communities in this type may be representatives of the *Poa cusickii* ecological type at moderate similarity to PNC.

JUBA c.t. (Manning and Padgett, 1995) Some communities in this type may be representatives of this ecological type at low to moderate similarity to PNC.

JUNE c.t. (Manning and Padgett, 1995) This undescribed miscellaneous community type, sampled by Manning and Padgett would most likely fall within this ecological type.

POCU c.t. (Manning and Padgett, 1995) This miscellaneous community type, sampled by Manning and Padgett would definitely be considered part of this ecological type.

Characteristic Vegetation of the *Poa cusickii ssp. epilis* -- Aquic Haplocryoll -- Trough drainageway and Floodplain ecological type

Plant Code	Scientific Name	Percent Constancy	Cover Range	Similarity to PNC
Grasses				
POCU3	*Poa cusickii ssp. epilis*	100	3-40	High
HOBR2	*Hordeum brachyantherum*	50	1-18	Low
POPR	*Poa pratensis*	30	1-8	Moderate
ELTRT	*Elymus trachycaulus ssp. trachycaulus*	30	3-6	High
DECE	*Deschampsia cespitosa*	20	1-3	High
MUFI2	*Muhlenbergia filiformis*	20	2-5	Moderate
MURI	*Muhlenbergia richardsonis*	20	1-2	Moderate
STNE3	*Achnatherum nelsonii*	10	2	Moderate
FERU2	*Festuca rubra*	10	1	Moderate
Grasslikes				
CANE2	*Carex nebrascensis*	70	1-16	High
JUBA	*Juncus balticus*	60	2-55	Moderate
CAAT3	*Carex athrostachya*	50	1-4	High
CAMI7	*Carex microptera*	40	2-14	Moderate
CASI2	*Carex simulata*	20	3-4	High
JUNE	*Juncus nevadensis*	20	2-24	High
CAHE8	*Carex heteroneura*	10	3	High
Forbs				
TRLO	*Trifolium longipes*	80	1-18	Moderate
ASOC	*Aster occidentalis*	60	1-30	Low
RAAL	*Ranunculus alismifolius*	50	1-32	Low
POBI6	*Polygonum bistortoides*	40	1-9	Moderate
POGR9	*Potentilla gracilis*	40	2-7	Low
ACMI2	*Achillea millefolium*	40	1-14	Low
PODO4	*Polygonum douglasii*	40	1-6	Low
LIHA	*Linanthus harknessii*	30	1-7	Low
STLOL3	*Stellaria longipes ssp. longipes*	30	1	High
PERYO	*Penstemon rydbergii var. oreocharis*	20	4-10	Moderate
EPCI	*Epilobium ciliatum*	20	1	Moderate
GARA2	*Gayophytum ramosissimum*	20	2-3	Low
PEPA21	*Perideridia parishii*	20	1-9	Moderate
ROCU	*Rorippa curvasiliqua*	20	1	Low
MOLI4	*Montia linearis*	10	2	Moderate
DUHO	*Dugaldia hoopesii*	10	10	Low
HYAN2	*Hypericum anagalloides*	10	1	Moderate
SIOR	*Sidalcea oregana*	10	1	Low
PELE5	*Perideridia lemmonii*	10	2	Moderate
CISC2	*Cirsium scariosum*	10	1	Moderate
POPO4	*Polygonum polygaloides*	10	2	Low
HAFL2	*Hackelia floribunda*	10	1	Low
COTO	*Collinsia torreyi*	10	3	Low

***Poa cusickii ssp. epilis* -- Aquic Haplocryoll -- Trough drainageway and floodplain**

Location _____

Field Recorders _____

Date _____ Frame Size: 10 X 10 cm

Use Moist Meadow Indicator Values for Any Additional Species

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total
Species Indicating High Similarity to PNC																					
POCU3																					
CANE2																					
CAAT3																					
STLOL3																					
ELTRT																					
DECE																					
CASI2																					
Species Indicating Moderate Similarity to PNC																					
TRLO																					
JUBA																					
POBI6																					
CAMI7																					
POPR																					
MUFI2																					
MURI																					
Species Indicating Low Similarity to PNC																					
ASOC																					
HOBR2																					
RAAL																					
POGR9																					
ACMI2																					
PODO4																					

Environmental Features

Scorecard Values:

Rooting Depth (cm) _____ (many, fine or very fine roots)

Vegetation basal cover _____

Mapping Values:

Soil Taxa _____

Landform _____

Form # 17-2060-36 (9/98)

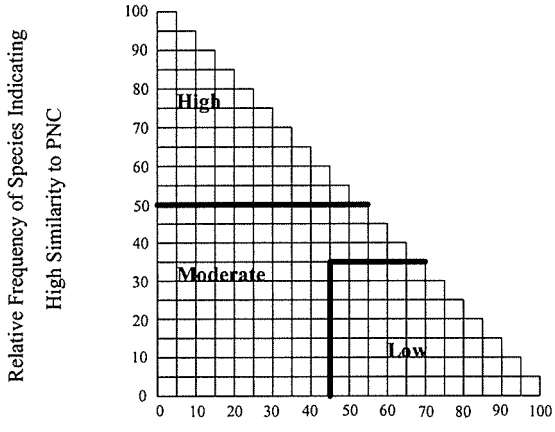
Poa cusickii ssp. *epilis*-- Aquic Haplocryoll -- Trough drainageway and Floodplain

Location: _____

Scorer: _____

Sample Date: _____

Vegetation similarity to PNC



Scorecard		
Ecological Status	Description	Notes
High Similarity to PNC	Vegetation has high similarity to PNC Vegetation basal cover 21 - 33 cm Rooting depth (many) 17 - 30 cm	
Moderate Similarity to PNC	Vegetation has moderate similarity to PNC Vegetation basal cover 10 - 20 cm Rooting depth (many) 10 - 16 cm	
Low Similarity to PNC	Vegetation has low similarity to PNC Vegetation basal cover 0 - 9 cm Rooting depth (many) 0 - 9 cm	

***Carex scopulorum* -- Typic Cryaquoll -- Trough dainageway ecological type**

MOUNTAIN SEDGE ECOLOGICAL TYPE

Sample size = 18 plots

Ploto - Plot 94567, Little Wolf Creek

Landform and Setting

Sampled at higher elevations ranging from 8300 to 9600 feet. All the soils sampled are cold. Soil temperature at 50cm averages 9 °C. Soils are saturated in the growing season; average depth to saturation is 43cm. Most sites (61%) have field indicators of hydric soils in the upper 30cm. Key field indicators (USDA, Natural Resources Conservation Service, 1998a) are redoximorphic features: a)F6, redox concentrations - diffuse red to yellow bodies of apparent accumulation of iron oxides within a dark surface soil; b)F8, redox concentration associated with depressions as drainageways, hummocks and floodplains; and c)TF8, redox concentrations at springs. At a few sites, indicator A9, thin muck layers occurs. With appropriate vegetation, saturation and hydric soils, all sites in this type key to jurisdictional wetlands. Within one meter of the soil surface, 94% of sites have redoximorphic features. A common soil is a Typic Cryaquoll; also common are soils with thin mollic layers, Oxyaquic Cryochrepts. The surface soils have a fine sand texture, with average D_{50} = 286 microns and D_{10} = 64 microns. Average valley slope of 4% and average lateral slope of 5% provide aeration in saturated conditions. This type is most commonly found on trough drainageways (40%). Also present on floodplains and springs. Sampled in drainages of the Walker, Carson and Truckee rivers

Description of Ecological Type Dynamics

Potential Natural Community (PNC) - Dominant cover of *Carex scopulorum* and/or *Deschampsia cespitosa* is indicative of high similarity to PNC. Typically, *Carex scopulorum* grows in dense, monospecific stands on late successional sites. *Carex scopulorum* replaces *Carex nebrascensis* at higher elevations in the eastern Sierra Nevada and grows on colder soils. This type has high erosion control potential.

Disturbance Pathways - This type is vulnerable to disturbance from grazing because these sites are preferred areas for livestock and provide high value forage. They are particularly susceptable to compaction due to fine textured soils and soil moistures which are moist but often not saturated. With increased disturbance, sites in this type tend to loose the dominance of *Carex scopulorum.* Forbs indicative of low ecological function become more and more dominant. This site is particularly prone to "invasion" of *Veratrum californicum var. californicum* and/or *Polygonum bistortoides.*

Irregardless of ecological status, sites in this ecological type fit the criteria for jurisdictional wetlands. Efforts should be made to maintain and improve ecological function of these sites.

Cross References to Other Classifications

Carex aquatilis -- Cryaquoll -- Spring ecological type (Weixelman, et al. 1996) is the equivalent of this type in Central Nevada.

Rocky Mountain Sedge Series (Sawyer and Keeler-Wolf, 1995) includes communities in this ecological type that are at moderate to high similarity to PNC.

Sedge Series (Sawyer and Keeler-Wolf, 1995) includes some plant communities where *Carex scopulorum* is present but not dominant and where environmental factors key the site to this ecological type. Most of these communities represent low to moderate similarity to PNC.

POBI3 c.t. (Smith, 1998 draft) describes a community type in this ecological type with low similarity to PNC.

VECA1 c.t. (Smith, 1998 draft) at least in part describes a community type in this ecological type with low similarity to PNC.

CASC c.t. (Manning and Padgett, 1995) represents moderate to high ecological status in this ecological type.

CASI c.t. (Manning and Padgett, 1995) particularly those sites with co-dominance of *Carex scopulorum, Carex nebrascensis* and/or *Deschampsia cespitosa* represent moderate to high similarity to PNC in this ecological type.

POPR c.t. (Manning and Padgett, 1995) includes some sites that are in this ecological type and which probably represent moderate similarity to PNC.

DECE c.t. (Manning and Padgett, 1995) is a community type with high similarity to PNC in this ecological type.

VECAC c.t. (Manning and Padgett, 1995) represents a community type that has low similarity to PNC and which may be "stuck" in this condition.

Tufted Hairgrass Class (Ratliff, 1982) includes associations which represent moderate to high similarity to PNC in this ecological type.

Characteristic Vegetation of the *Carex scopulorum* -- Typic Cryaquoll -- Trough drainageway ecological type

Plant Code	Scientific Name	Percent Constancy	Cover Range	Similarity to PNC
Grasses				
POPR	*Poa pratensis*	37	1-30	Moderate
DECE	*Deschampsia cespitosa*	37	1-40	High
HOBR2	*Hordeum brachyantherum*	37	1-13	Low
MUFI2	*Muhlenbergia filiformis*	25	1-15	Moderate
POCU3	*Poa cusickii*	25	1-9	High
PHAL2	*Phleum alpinum*	25	1-2	High
AGEX	*Agrostis exarata*	18	1-2	Low
ACLE9	*Achnatherum lettermanii*	12	3-22	Low
Grasslikes				
CASC12	*Carex scopulorum*	81	1-78	High
CAMI7	*Carex microptera*	31	1-15	Moderate
CASI2	*Carex simulata*	31	1-24	High
JUBA	*Juncus balticus*	31	1-11	Moderate
CASU7	*Carex subnigricans*	25	10-13	High
JUOR	*Juncus orthophyllus*	25	1-12	Moderate
CAHE8	*Carex heteroneura*	18	1-13	High
CANE2	*Carex nebrascensis*	18	3-14	High
CAPR8	*Carex preslii*	12	1-3	
Forbs				
TRLO	*Trifolium longipes*	62	1-16	Moderate
ASOC	*Aster occidentalis*	56	1-10	Low
EPCI	*Epilobium ciliatum*	56	1-4	Moderate
POBI6	*Polygonum bistortoides*	50	1-76	Moderate
MIPR	*Mimulus primuloides*	37	1-4	Moderate
DOAL	*Dodecatheon alpinum*	31	1-3	High
RAAL	*Ranunculus alismifolius*	25	1-16	Low
GEMA4	*Geum macrophyllum*	25	1-3	Low
MOCH	*Montia chamissoi*	25	1-4	Moderate
STLOL3	*Stellaria longipes*	25	1	Moderate
TRMO2	*Trifolium monantum*	25	3-26	Moderate
TRWO	*Trifolium wormskioldii*	18	1-3	Moderate
VECAC-2	*Veratrum californicum var. californicum*	18	1-67	Moderate
ASALA	*Aster alpigenus var. andersonii*	18	2-20	Low
TAOF	*Taraxacum officinale*	18	1-3	Low
POGR9	*Potentilla gracilis*	12	1	Low
PODO4	*Polygonum douglasii*	12	1-5	Low
ACMI2	*Achillea millefolium*	12	3-7	Low
CABR6	*Cardamine brewerii*	12	1-2	Low
GABI	*Galium bifolium*	12	1	Moderate

***Carex scopulorum* -- Typic Cryaquoll -- Trough drainageway**

Location _____

Field Recorders _____

Date _____ Frame Size: 10 X 10 cm

Use Wet Meadow Indicator Values for Any Additional Species

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	To-tal
Species Indicating High Similarity to PNC																					
CASC12																					
CASI2																					
DOAL																					
POCU3																					
CASU7																					
PHAL2																					
Species Indicating Moderate Similarity to PNC																					
TRLO																					
POBI6																					
POPR																					
DECE																					
MIPR																					
CAMI7																					
JUBA																					
Species Indicating Low Similarity to PNC																					
ASOC																					
HOBR2																					
RAAL																					
GEMA4																					
ASALA																					
TAOF																					
AGEX																					

Environmental Features

Scorecard Values:

Soil cover _____

Rooting Depth (cm) _____ (common, fine or very fine roots)

Mapping Values:

Soil Taxa _____

Landform _____

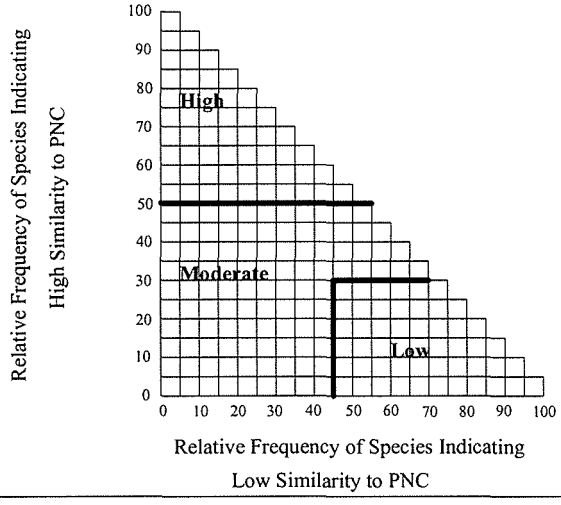
Carex scopulorum - Typic Cryaquoll - Trough drainageway

Location: _____

Scorer: _____

Sample Date: _____

Vegetation similarity to PNC



Scorecard		
Ecological Status	Description	Notes
High Similarity to PNC	Vegetation has high similarity to PNC Rooting depth (common) 42 - 56 cm Soil cover 0 - 3 percent	
Moderate Similarity to PNC	Vegetation has moderate similarity to PNC Rooting depth (common) 32 - 41 cm Soil cover 4 - 18 percent	
Low Similarity to PNC	Vegetation has low similarity to PNC Rooting depth (common) 0 - 31 cm Soil cover 19 - 57 percent	

***Carex utriculata* -- Oxyaquic Haplocryoll -- Floodplain ecological type**

BEAKED SEDGE ECOLOGICAL TYPE

Sample size = 11 plots

Photo - Plot 96717, Franktown Creek

Landform and Setting

Soils are ponded or saturated at the soil surface well into *Carex* flowering. Drainage may occur late into the growing season, for an average depth to saturation of 18cm. Most soils (64%) exhibit field indicators of hydric soils in the upper 30cm. Thin to thick layers of peat, muck or mucky mineral material are common hydric indicators at 46% of sites. Key field indicators (USDA, Natural Resources Conservation Service, 1998a) are: a)A1, histosol; b)A9, at least 1cm muck layer; c)TF1, a mucky peat or peat layer; d)F1, loamy-mucky mineral layer. Redoximorphic features occurred as redox concentrations of iron oxides in the dark surface (18% have indicator F6) or as soil redox depletions with chroma of 2 or less (18% have indicators F4 and F5). With appropriate vegetation, saturation and hydric soils, all sites in this type are juridictional wetlands. The most common soil is an Oxyaquic Haplocryoll with a thin peat or muck layer. In the late season, after drainage, these soils may be confused with Cumulic Haplocryolls. Soils are formed in medium to fine sands with average grain size D_{50} = 401 microns and D_{10} = 49 microns. This very wet type is found most commonly on floodplains and as springs along the edge of the floodplain (73%). In springs, there is enough organic matter accumulation to form Histosolls. This type may also occur in drainageways where water ponds without defined channels (27%). Valley slope tends to be about 3%. Lateral slope averages 1%. Elevation ranged from 6500 to 8600 feet. Soil temperature at 50cm averages 10 °C. The sites were distributed throughout the Walker, Carson and Truckee river basins.

Description of Ecological Type Dynamics

Potential Natural Community (PNC) - This ecological type is characterized by a very high cover of *Carex utriculata* at PNC. There are few other species in the stand. *Carex vesicaria* and *Carex nebrascensis* and *Deschampsia cespitosa* are common associated

species. There is evidence of both soil and litter accumulation on PNC sites. *Carex utriculata* colonizes ponds and sites adjacent to stream channels. The potential for erosion control is high as these deep-rooted, perennial, rhizomatous species are important for stabilizing streambanks. Sjoberg and Danell (1983) noted that shoot density of *Carex utriculata* is highest on sites that are only seasonally flooded; continually inundated sites had decreased shoot density. As soil is deposited, sites may give way to *Carex nebrascensis*. This sometimes happens as old beaver ponds silt in and transition to *Carex nebrascensis* sites.

Disturbance Pathways - Soil moisture within the rooting zone generally declines as similarity to PNC is reduced. Drying may be indicated by a decline in organic matter, and increase in compaction or by associated incision (gullying and watertable decline). Species increase in diversity as holes develop in the sward of *Carex utriculata*. Disturbance indicator species are *Hordeum brachyantherum, Cardamine brewerii, Eleocharis pauciflora* and *Senecio hydrophilus*.

Irregardless of ecological status, sites in this ecological type fit the criteria for jurisdictional wetlands. Efforts should be made to maintain and improve ecological function of these sites.

Cross Refererences to Other Classifications

Carex nebrascensis -- Cryaquoll -- Trough floodplain ecological type (Weixelman et.al. 1996) The *Carex rostrata (Carex utriculata)* communities were included in the *Carex nebrascensis* ecological type for Central Nevada because too few were sampled to separate them as a distinct type and because they were considered to be on a seral gradient with *Carex nebrascensis* sites.

CARO2 c.t. (Smith, 1998 draft) This community type describes this ecological type at or near PNC.

Carisetum rostratae association (Nachlinger, 1985) This association is one similar to PNC for this ecological type.

CARO c.t. (Manning and Padgett, 1995) Manning and Padgett consider this an early seral community to CASI, CANE2, or DECA. We feel that a stable late seral ecological type exists with *Carex utriculata* as the dominant species. We do also recognize that with soil accumulation or reduction in water availability, these sites may naturally progress toward other ecological types.

Beaked sedge series (Sawyer and Keeler-Wolf, 1995) This series includes plant communities with moderate to high similarity to PNC in this ecological type.

Characteristic Vegetation of the *Carex utriculata* -- Oxyaquic Haplocryoll -- Floodplain ecological type

Plant Code	Scientific Name	Percent Constancy	Cover Range	Similarity to PNC
Grasses				
DECE	*Deschampsia cespitosa*	40	1-6	High
POPR	*Poa pratensis*	40	2-8	Moderate
MUFI2	*Muhlenbergia filiformis*	20	1-12	Moderate
BRAN	*Bromus anomalus*	10	1	Low
LETR5	*Leymus triticoides*	10	5	Moderate
HOBR2	*Hordeum brachyantherum*	10	1	Low
FERU2	*Festuca rubra*	10	2	Moderate
MURI	*Muhlenbergia richardsonis*	10	1	Moderate
Grasslikes				
CAUT	*Carex utriculata*	80	1-76	High
CANE2	*Carex nebrascensis*	70	1-11	High
CAPR5	*Carex praegracilis*	30	3-10	High
ELPA6	*Eleocharis pauciflora*	20	1-4	Moderate
JUBA	*Juncus balticus*	20	3-8	Moderate
JUOR	*Juncus orthophyllus*	20	1-4	Moderate
JUCOO	*Juncus covillei var. obtusatus*	10	1	Moderate
CAVE6	*Carex vesicaria*	10	45	High
Forbs				
ARCHF	*Arnica chamissonis foliosa*	30	1-3	Low
CABR6	*Cardamine brewerii*	30	2-8	Low
EPCI	*Epilobium ciliatum*	30	1-6	Moderate
POBI6	*Polygonum bistortoides*	20	2-8	Moderate
GEMA4	*Geum macrophyllus*	20	1-4	Low
POGR9	*Potentilla gracilis*	20	2	Low
VEAM2	*Veronica americana*	20	2-15	Moderate
SAOR2	*Saxifraga oregana*	20	4-42	Moderate
STLOL3	*Stellaria longipes var. longipes*	20	1	Moderate
TAOF	*Taraxacum officinale*	20	2	Low
GALIU	*Galium spp.*	20	1	Moderate
ASOC	*Aster occidentalis*	10	13	Low
ANRO2	*Antennaria rosea*	10	1	Low
ACMI2	*Achillea millefolium*	10	2	Low
SEHY2	*Senecio hydrophilus*	10	10	Moderate
VISOA	*Viola sororia ssp. affinis*	10	2	Moderate
AGGL	*Agoseris glauca*	10	3	Low
IRMI	*Iris missouriensis*	10	6	Low
Shrubs				
SAGE2	*Salix geyeriana*	10	1	High
ARCA13	*Artemisia cana*	10	6	Low

***Carex utriculata* -- Oxyaquic Haplocryoll -- Floodplain ecological type**

Location _____

Field Recorders _____

Date _____ Frame Size: 10 X 10 cm

Use Wet Meadow Indicator Values for Any Additional Species

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	To-tal
Species Indicating High Similarity to PNC																					
CAUT																					
CANE2																					
DECE																					
CAPR5																					
CAVE6																					
SAGE2																					
Species Indicating Moderate Similarity to PNC																					
POPR																					
EPCI																					
MUFI2																					
ELPA6																					
JUBA																					
JUOR																					
POBI6																					
Species Indicating Low Similarity to PNC																					
CABR6																					
ARCHF																					
GEMA4																					
POGR9																					
TAOF																					
HOBR2																					
BRAN																					

Environmental Features

Scorecard Values:

Rooting Depth (cm) _____ (many, fine or very fine roots)

Color Value (dry) of the surface soil _____

Mapping Values:

Soil Taxa _____

Landform _____

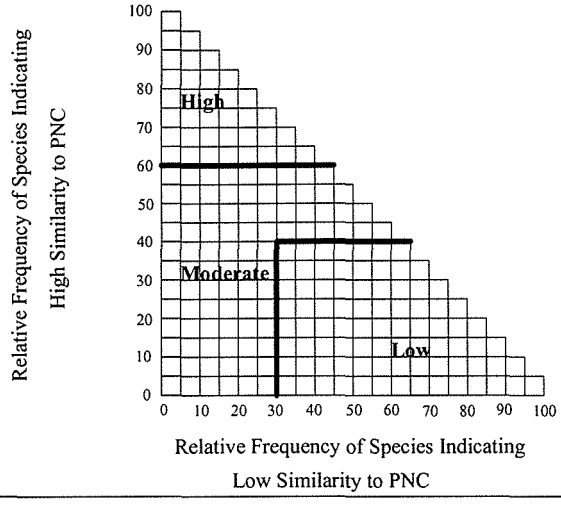
Carex utriculata -- Oxyaquic Haplocryoll -- Floodplain

Location: _____

Scorer: _____

Sample Date: _____

Vegetation similarity to PNC



Scorecard		
Ecological Status	Description	Notes
High Similarity to PNC	Vegetation has high similarity to PNC Rooting depth (many) 37 - 79 cm Color value (dry) 2 - 3	
Moderate Similarity to PNC	Vegetation has moderate similarity to PNC Rooting depth (many) 14 - 36 cm Color value (dry) 4	
Low Similarity to PNC	Vegetation has low similarity to PNC Rooting depth (many) 0 - 13 cm Color value (dry) 4	

Form # 17-2060-41 (9/98)

***Carex nebrascensis* -- Typic Cryaquoll -- Drainageway ecological type**

NEBRASKA SEDGE ECOLOGICAL TYPE

Sample size = 39 plots

Photo - Plot 94528, Aurora Canyon

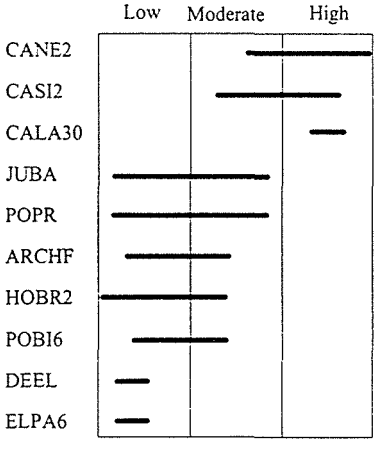
Landform and Setting

Sites are wet or moist well into the growing season. Depth to saturation averages 34cm. Most sites, 77%, have field indicators of hydric soils (USDA, Natural Resources Conservation Service, 1998a) in the upper 30cm . Key field indicators are redoximorphic features: a) F6, redox concentrations - diffuse red to yellow bodies of apparent accumulation of iron oxides with a dark surface soil; b) F4, redox depeletion with chroma of 2 or less and redox concentration below a dark surface is common (31% have indicators F4 and F5). Additional indicators are thin to thick layers of muck or muck mineral material and peat leayers. Decayed organic matter as muck layers (indicators A9, A5 and A2) and mucky mineral (indicator F1) occur on 28% of sites. Peat rich sites with dense fibrous sod are common, 54%. With appropriate vegetation, saturation and hydric soils, all sites in this type are jurisdictional wetlands. The most common soil taxa is Typic Cryaquoll with a peat or muck rich surface layer. Several sites (25%) lack thick dark surface color and organic matter incorporation to be Cryaquolls however most have thin muck or peat layers. Soil temperature at 50cm depth averages 11 °C. Elevations range from 5820 to 9200 feet. This type is most common on drainageways (79%) but also found on floodplains (36%). Valley slope tends to be about 3%. Lateral slope averages 2% but ranges from 0 to 7%. Average surface soil grain size is fine to medium sand (average D_{50} = 402 microns). The finest 10 percent is silt to fine sand sized (average D_{10} = 76 microns). Sampled in the Walker, Carson and Truckee river basins. In Central Nevada, the *Deschampsia cespitosa* plant community was found in sandier environs and a seperate ecological type. In the Sierras, *Deschampsia* shares the same ecological type with *Carex nebrascensis*.

Description of Ecological Type Dynamics

Potential Natural Community (PNC) - When *Carex nebrascensis* dominates these sites, it should be considered the Potential Natural Community. *Carex nebrascensis* is highly rhizomatous and outcompetes other species that grow on the same sites. However, depending on local moisture conditions and species that are present, *Carex nebrascensis* may not always be the dominant at PNC. PNC should be defined by the relative frequency of plant species that indicate high similarity to PNC. Other species that indicate a high similarity to PNC and may dominate at PNC include *Deschampsia cespitosa, Carex simulata* and *Carex lanuginosa*. *Carex lanuginosa* is an indicator of coarser soil material. On wetter sites, this ecological type grades into the *Carex utriculata* type and *Carex utriculata* may be present. Conversely, on drier sites, this type grades into the Mesic Graminoid ecological type.

Plant communities within the *Carex nebrascensis* ecological type and their relationship to ecological status



Disturbance Pathways - Under grazing or trampling pressure, *Carex nebrascensis* and *Deschampsia cespitosa* can be replaced by species with a wider ecological amplitude such as *Juncus balticus* or *Poa pratensis*. This is especially true when accompanied by a drop in the water table. Once *Juncus balticus* or *Poa pratensis* becomes well established, it may persist as a relatively stable community dominant. Studies on riparian areas in central Nevada have shown that *Poa pratensis* can be replaced by *Carex nebrascensis* within 5 to 10 years with complete rest from grazing. Replacement of *Juncus balticus* with *Carex spp.* has been slower. Various forb species including *Aster spp, Trifolium spp., Achillea millefolium* and *Taraxacum officinale* increase cover under heavy grazing. Erosion control afforded by *Carex nebrascensis* is high; it is valuable for streambank stability because of its strong rhizomes. Erosion control value for *Juncus balticus* is moderate to high depending on plant vigor. Plants with low vigor have less root biomass to stabilize streambanks. *Eleocharis pauciflora* is a common pioneer species on new streambars in this type. This species can persist into later seral stages and is valuable as a rhizomatous soil binder.

Irregardless of ecological status, sites in this ecological type fit the criteria for jurisdictional wetlands. Efforts should be made to maintain and improve ecological function of these sites.

Cross References to Other Classifications

Carex nebrascensis -- Cryaquoll -- Trough floodplain e.t. (Weixelman, et.al 1996) is an ecological type that differs from that in the Sierra region by having slightly finer surface soil material. The Sierran *Carex nebrascensis* type is broader in environmental amplitude.

CANE1 c.t. (Smith, 1998 draft) This is a community type with high similarity to PNC in this ecological type.

ELPA c.t. (Manning and Padgett, 1995) This is a community type with low similarity to PNC in this ecological type or others. Often this is a pioneer community.

CASI c.t. (Manning and Padgett, 1995) This community type has moderate similarity to PNC in this ecological type.

CARO c.t. (Manning and Padgett, 1995) Manning and Padgett consider this community type to be successional to the *Carex nebrascensis* c.t. This may be the case or this community may more accurately describe high similarity to PNC in the *Carex utriculata* ecological type

DECA/CANE2 c.t. (Manning and Padgett, 1995) This community type represents this ecological type at moderate to high similarity to PNC.

CANE2 c.t. (Manning and Padgett, 1995) This community type represents this ecological type at moderate to high similarity to PNC.

CALA c.t. (Manning and Padgett, 1995) This community type represents this ecological type or others at low to moderate similarity to PNC.

JUBA c.t. (Manning and Padgett, 1995) This community type represents this ecological type or others at low to moderate similarity to PNC.

Nebraska sedge (R. D. Ratliff, 1982) This is a PNC class within this ecological type.

Nebraska sedge series (Sawyer and Keeler-Wolf, 1995) Plant communities in this series are examples of this ecological type at moderate to high similarity to PNC.

Characteristic Vegetation of the *Carex nebrascensis* -- Typic Cryaquoll -- Drainageway ecological type

Plant Code	Scientific Name	Percent Constancy	Cover Range	Similarity to PNC
Grasses				
POPR	*Poa pratensis*	51	2-40	Moderate
DECE	*Deschampsia cespitosa*	33	1-20	High
MURI	*Muhlenbergia richardsonis*	30	1-15	Moderate
POSEJ	*Poa secunda ssp. juncifolia*	17	1-18	High
HOBR2	*Hordeum brachyantherum*	17	1-20	Low
AGST2	*Agrostis stolonifera*	12	1-3	Low
MUFI2	*Muhlenbergia filiformis*	12	1-6	Moderate
FERU2	*Festuca rubra*	10	1-15	Moderate
Grasslikes				
JUBA	*Juncus balticus*	84	1-45	Moderate
CANE2	*Carex nebrascensis*	82	2-80	High
CASI2	*Carex simulata*	35	1-43	High
ELPA6	*Eleocharis pauciflora*	30	1-26	Moderate
JUOR	*Juncus orthophyllus*	28	1-11	Moderate
CAMI7	*Carex microptera*	15	1-19	Moderate
ELMA5	*Eleocharis macrostachya*	12	1-3	Moderate
CAAT3	*Carex athrostachya*	10	1-9	High
Forbs				
TAOF	*Taraxacum officiale*	48	1-27	Low
EPCI	*Epilobium ciliatum*	43	1-6	Moderate
TRLO	*Trifolium longipes*	43	1-29	Moderate
STLOL3	*Stellaria longipes var. longipes*	41	1-3	Moderate
MIPR	*Mimulus primuloides*	41	1-3	Moderate
ASOC	*Aster occidentalis*	41	1-21	Low
MOCH	*Montia chamissoi*	41	1-10	Moderate
ACMI2	*Achillea millefolium*	33	1-18	Low
POGR9	*Potentilla gracilis var. fastigiata*	30	1-11	Low
ARCHF	*Arnica chamissonis ssp. foliosa*	30	1-27	Low
RAAL	*Ranunculus alismifolius*	20	1-3	Low
PERYO	*Penstemon rydbergii var. oreocharis*	17	1-3	Moderate
POBI6	*Polygonum bistortoides*	15	1-22	Moderate
TRWO	*Trifolium wormskioldii*	15	1-8	Moderate
SOTR	*Solanum triflorum*	12	1-3	Low
IRMI	*Iris missouriensis*	12	1-8	Low
GABI	*Galium bifolium*	10	1-6	Moderate
VEAM2	*Veronica americana*	10	1-3	Moderate
Shrubs				
SAGE2	*Salix geyeriana*	10	1-3	High

***Carex nebrascensis* -- Typic Cryaquoll -- Drainageway**

Location _____

Field Recorders _____

Date _____ Frame Size: 10 X 10 cm

Use Wet Meadow Indicator Values for Any Additional Species

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total
Species Indicating High Similarity to PNC																					
CANE2																					
CASI2																					
DECE																					
POSEJ																					
CAAT3																					
SAGE2																					
Species Indicating Moderate Similarity to PNC																					
JUBA																					
POPR																					
EPCI																					
TRLO																					
MIPR																					
MOCH																					
STLOL3																					
ELPA6																					
Species Indicating Low Similarity to PNC																					
TAOF																					
ASOC																					
ACMI2																					
POGR9																					
ARCHF																					
RAAL																					

Environmental Features

Scorecard Values:

Rooting Depth (cm) _____ (many, fine or very fine roots)

Rooting Depth (cm) _____ (common, fine or very fine roots)

Mapping Values:

Soil Taxa _____

Landform _____

Form # 17-2060-42 (9/98)

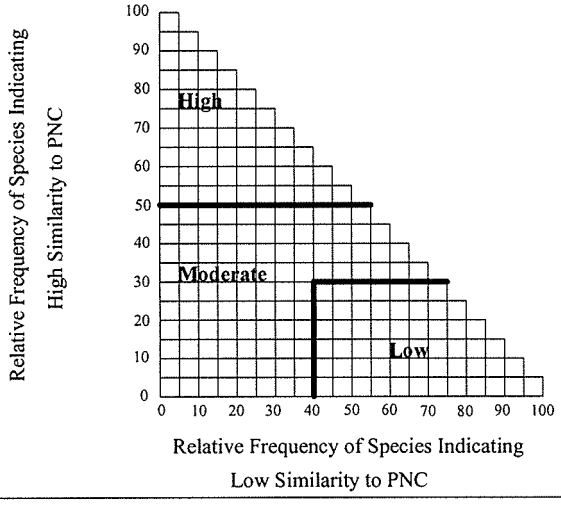
Carex nebrascensis - Typic Cryaquoll - Drainageway

Location: _____

Scorer: _____

Sample Date: _____

Vegetation similarity to PNC



Scorecard		
Ecological Status	Description	Notes
High Similarity to PNC	Vegetation has high similarity to PNC Rooting depth (many) 13 - 40 cm Rooting depth (common) 44 - 66 cm	
Moderate Similarity to PNC	Vegetation has moderate similarity to PNC Rooting depth (many) 9 - 12 cm Rooting depth (common) 24 - 43 cm	
Low Similarity to PNC	Vegetation has low similarity to PNC Rooting depth (many) 0 - 8 cm Rooting depth (common) 0 - 23 cm	

Mesic graminoid -- Oxyaquic Haplocryoll -- Drainageway ecological type

MESIC GRAMINOID ECOLOGICAL TYPE

Sample size = 26 plots

Photo - Plot 96724, Hot Springs Creek

Landform and Setting

Saturation was encountered below 50cm 69% of the time. Most (65%) soils lacked redoximorphic features . The most common soils (27%) were Oxyaquic Haplocryolls that are saturated deep in the profile and lack redoximorphic features. The most common unsaturated soils were Typic to Pachic Haplocryolls (27%). Some (12%) soils lacked sufficient organic matter accumulation to be classed as Mollisols . Soil temperature at 50cm averages 12 °C. Elevation ranged from 5790 to 9600 feet. Surface soil material was medium sand with an average D_{50} of 486 microns. The D_{10} grain size averaged 68 microns (fine sand and silt texture). Most commonly found on trough drainageways (54%) and floodplains (35%). Valley slope averages 4%. Lateral slope ranges from 1 to 8% and averages 3%. Sampled in the Walker, Carson and Truckee river basins.

Description of Ecological Type Dynamics

Potential Natural Community (PNC) - Plant communities that represent conditions similar to PNC tend to be dominated by graminoids and grasslikes. Dominant species include *Carex nebrascensis, Poa secunda ssp. juncifolia, Carex praegracilis, Carex athrostachya* or *Carex simulata*. In some cases, *Poa pratensis* or *Juncus balticus* dominated sites may represent high similarity to PNC. Measures of site function such as rooting depth and ground cover should be used in these cases to determine similarity to PNC. *Poa pratensis* and *Juncus balticus* may also outcompete many native graminoid species following disturbance setting up a relatively stable disclimax.

Disturbance Pathways - This type has high erosion control potential, yet is frequently found in degraded condition. Heavy grazing or soil compaction causes a decline in perennial rhizomatous graminoid species and favors the establishment of early seral,

shallow-rooted forb species. Disturbance species such as *Iris missouriensis, Potentilla gracilis, Achillea millefolium* and *Agrostis stolonifera* are typically present on sites that are degraded. This is one of the dominant meadow types in and around campgrounds, because of its soil moisture status. The same factors which make it desirable for camping also make it very susceptible to compaction. In addition livestock prefer these sites for forage and loafing, often resulting in addional compaction. Managing for mid and higher similarity to PNC on these sites reduces runoff and erosion due to increases in rates of infiltration and higher cover of vegetation and litter.

Cross References to Other Classifications

Mesic graminoid -- Aquic Cryoboroll -- Trough drainageway ecological type (Weixelman et.al., 1996) The setting for this ecological type from Central Nevada is quite similar but scorecard values differ slightly in the Sierra.

Nebraska Sedge Class (Ratliff, 1982) This class represents high similarity to potential natural community in this ecological type.

Kentucky Bluegrass Class (Ratliff, 1982) This class represents low to moderate similarity to potential in this ecological type.

POPR1 c.t. (Smith, 1998 draft) This community type represents low to moderate similarity to potential in this ecological type.

JUBA c.t. (Smith, 1998 draft) This community type may represent a full range of similarity to PNC. If the plant assemblage includes indicators of high simiarity to PNC, such as *Carex praegracilis* or *Carex athrostachya*, and includes good soil indicators of ecosystem function then the community represents high ecological status.

PONE2 association (Smith, 1998 draft) This species is an indicator of high similarity to PNC in this ecological type. Communities dominated by this species are likely to represent high similarity to PNC.

CAAT2 c.t. (Smith, 1998 draft) Prevalence of *Carex athrostachya* indicates high similarity to PNC.

Kentucky bluegrass series (Sawyer and Keeler-Wolf, 1995) Communities in this series may represent low to moderate similarity to PNC in this ecological type.

Nebraska sedge series (Sawyer and Keeler-Wolf, 1995) Communities in this series may represent moderate to high similarity to PNC in this ecological type or in other ecological types such as the *Carex nebrascensis* e.t.

Subalpine Meadow Habitat (Sawyer and Keeler-Wolf, 1995) A few communities in this habitat may also represent this ecological type with varying degrees of similarity to PNC.

Montane Meadow Habitat (Sawyer and Keeler-Wolf, 1995) A few communities in this habitat may also represent this ecological type with varying degrees of similarity to PNC.

POPR c.t. (Manning and Padgett, 1995) represents low to moderate similarity to PNC. A few sites with enough indicators of high similarity to PNC may represent high similarity to PNC.

JUBA c.t. (Manning and Padgett, 1995) Although *Juncus balticus* is a disturbance indicator, in this ecological type communities dominated by it and other moderate to high indicator species most often represent moderate to high similarity to PNC.

PONE c.t. (Manning and Padgett, 1995) This community is likely to represent high similarity to PNC in this ecological type.

AGST c.t. (Manning and Padgett, 1995) This community type represents low to moderate similarity to PNC. Although it occurs in moister settings, *Agrostis stolonifera* is grazing tolerant and a disturbance indicator.

JUOR c.t. (Manning and Padgett, 1995) This infrequently occurring community is a representative of low to moderate similarity to PNC.

IRMI/DG c.t. (Manning and Padgett, 1995) Where *Iris* cover is greater than 20% ecological status is probably low. Sites we sampled, had between one and fifteen percent cover of *Iris missouriensis* and represented moderate similarity to PNC.

Characteristic Vegetation of the Mesic graminoid -- Oxyaquic Haplocryoll -- Drainageway ecological type

Plant Code	Scientific Name	Percent Constancy	Cover Range	Similarity to PNC
Grasses				
POPR	*Poa pratensis*	73	1-71	Moderate
MURI	*Muhlenbergia richardsonis*	34	1-13	Moderate
POSEJ	*Poa secunda ssp. juncifolia*	26	1-60	High
HOBR2	*Hordeum brachyantherum*	26	1-6	Low
MUFI1	*Muhlenbergia filiformis*	23	1-22	Moderate
ELTRT	*Elymus tracycaulus ssp. trachycaulus*	15	1-2	High
POCUE	*Poa cusickii*	11	1-7	High
AGST2	*Agrostis stolonifera*	11	1-74	Low
FERU2	*Festuca rubra*	11	1-13	Moderate
Grasslikes				
JUBA	*Juncus balticus*	84	1-29	Moderate
CANE2	*Carex nebrascensis*	46	1-7	High
JUOR	*Juncus orthophyllus*	23	1-46	Moderate
CASI2	*Carex simulata*	19	1-17	High
CAPR5	*Carex praegracilis*	15	2-28	High
JUNE	*Juncus nevadensis*	15	1-7	High
CAAT3	*Carex athrostachya*	11	2-25	High
CAMI7	*Carex microptera*	11	1-5	Moderate
Forbs				
ASOC	*Aster occidentalis*	65	1-12	Low
TAOF	*Taraxacum officinale*	57	1-12	Low
POGR9	*Potentilla gracilis*	53	1-13	Low
ACMI2	*Achillea millefolium*	50	1-25	Low
IRMI	*Iris missouriensis*	46	1-15	Low
TRLO	*Trifolium longipes*	26	1-8	Moderate
ANRO2	*Antennaria rosea*	23	1-2	Low
AGGL	*Agoseris glauca*	23	1-4	Low
EPCI	*Epilobium ciliatum*	23	1-16	Moderate
PERYO	*Penstemon rydbergii*	19	1-6	Moderate
CISC2	*Cirsium scariosum*	15	1-6	Moderate
SIOR	*Sidalcea oregana*	15	1-4	Low
EQAR	*Equisetum arvense*	15	1	Low
STLOL	*Stellaria longipes ssp. longipes*	15	1-3	High
TROL	*Trifolium oliganthum*	11	4-37	Moderate
POBI6	*Polygonum bistortoides*	11	4-13	Moderate
TRWO	*Trifolium wormskioldii*	11	1-5	Moderate
PODO4	*Polygonum douglasii*	11	1-5	Low
MOCH	*Montia chamissoi*	11	1-2	Moderate
Shrubs				
ARCA13	*Artemisia cana*	15	1-13	Low
SAGE2	*Salix geyeriana*	11	1-3	High

Mesic graminoid -- Oxyaquic Haplocryoll -- Drainageway

Location _____

Field Recorders _____

Date _____ Frame Size: 10 X 10 cm

Use Mesic Meadow Indicator Values for Any Additional Species

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total
Species Indicating High Similarity to PNC																					
CANE2																					
POSEJ																					
CASI2																					
ELTRT																					
CAPR5																					
STLOL																					
Species Indicating Moderate Similarity to PNC																					
JUBA																					
POPR																					
MURI																					
TRLO																					
MUFI																					
JUOR																					
EPCI																					
Species Indicating Low Similarity to PNC																					
ASOC																					
TAOF																					
POGR9																					
ACMI2																					
IRMI																					
HOBR2																					
ANRO2																					

Environmental Features

Scorecard Values:

Rooting Depth (cm) _____ (many, fine or very fine roots)

Litter cover _____ Bare soil cover _____

Mapping Values:

Soil Taxa _____

Landform _____

Form # 17-2060-44 (8/98)

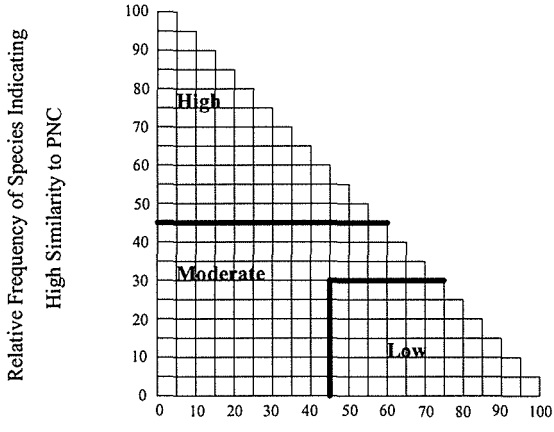
Mesic Graminoid - Oxyaquic Haplocryoll - Drainageway

Location: _____

Scorer: _____

Sample Date: _____

Vegetation similarity to PNC



Scorecard		
Ecological Status	Description	Notes
High Similarity to PNC	Vegetation has high similarity to PNC Rooting depth (many) 9 - 17 cm Litter cover 85 - 93 percent Soil cover 0 - 5 percent	
Moderate Similarity to PNC	Vegetation has moderate similarity to PNC Rooting depth (many) 6 - 8 cm Litter cover 61 - 84 percent Soil cover 6 - 28 percent	
Low Similarity to PNC	Vegetation has low similarity to PNC Rooting depth (many) 0 - 5 cm Litter cover 0 - 60 percent Soil cover 29- 100 percent	

Form # 17-2060-45 (8/98)

***Salix eastwoodiae* -- Cryaquoll -- Floodplain ecological type**

Sample size = 11 plots

Photo - Plot 95656, Frog Lake

Landform and Setting

This type occurs on willow dominated sites above 8400 feet. Elevations range from 6720 to 8700 feet. Soil temperature at 50 cm depth averages 9 °C. This type is commonly found on floodplains (64%) and drainageways (36%). Sites tend to be on steep landforms in open, glaciated cirques and valleys. Valley slopes average 6% and lateral slopes average 4%. Depth to saturation averages 35 cm and most soils (64%) have redoximorphic features. Sites that key to this type are considered jurisdictional wetlands. The most common soils were Typic Cryaquoll. Several soils lacked the organic matter accumulation to be classed as Mollisols; they are Cryaquents and Cryaquepts. Also common (36%) are Haplocryolls that are saturated without redoximorphic features. Surface soil materials are medium to fine sand with average grain sizes of D_{50} = 433 microns and D_{10} = 72 microns. Sampled in the Walker, Carson and Truckee river basins.

Description of Ecological Type Dynamics

Potential Natural Community (PNC) - Willow species dominate the overstory in these sites. Greater than 30% combined cover of one or more of the following species is expected on sites with high similarity to PNC: *Salix eastwoodiae, Salix orestra* or *Salix planifolia. Salix geyeriana* and *Salix lemmonii* may also be present. The understory is dominated by herbaceous species which thrive in cold, wet environments such as: *Carex scopulorum, Mimulus primuloides, Stellaria longipes, Carex subnigricans, Carex nebrascensis, Spiranthes romanzoffiana* and *Sphenosciadium capitellatum.* The species composition of the herbaceous layer provides information on the ecological status and health of the site. These sites have a high potential for providing stable streambanks and controlling surface erosion if a healthy willow stand is present and there is a dense herbaceous understory. These sites provide important wildlife cover for travel corridors and fawning/nesting habitat.

Disturbance Pathways - Trails, flood and snowslide damage may result in openings in the overstory cover on this ecological type. Because the soil surface is moist to wet for most of the growing season, these sites are susceptible to compaction from trampling by livestock or recreationists. *Carex scopulorum* and *Carex nebrascensis* have strong rhizomes and can maintain good cover under moderate disturbance. However, damaged rhizomes and weakened sedge vigor can allow for the establishment of early successional plant species. During snowmelt, trails may capture overland waterflow. The resultant drying of the site can also reduce the frequency of moisture loving species. Indicators of lowered similarity to PNC are species such as: *Achillea millefolium, Aster alpinius, Hordeum brachyantherum, Aster occidentalis* and *Potentilla gracilis.* Recovery is difficult and slow because of the harshness of this growing site.

Irregardless of ecological status, sites in this ecological type fit the criteria for jurisdictional wetlands. Efforts should be made to maintain and improve ecological function of these sites.

Cross References to Other Classifications

SAEA/CASC c.t. (Manning and Padgett, 1995) represents potential natural community within this ecological type when *Salix eastwoodae* dominates.

SAEA c.t. (Smith, 1998 draft) also represents potential natural community within this ecological type.

SAPL/CASC c.t. (Manning and Padgett, 1995) represents potential natural community within this ecological type when *Salix planifolia* dominates.

SAOR/TF c.t. (Manning and Padgett, 1995) may represent low to moderate similarity to PNC in this ecological type.

LOW SALIX/MF c.t. (Manning and Padgett, 1995) may represent low to moderate similarity to PNC in this ecological type.

Subalpine Wetland Shrub Habitat (Sawyer and Keeler-Wolf, 1995) Some plant communities in this habitat may be representatives of this ecological type. Ecological status depends on the relative abundance of high and low indicator species and their rooting depth.

Characteristic Vegetation of the *Salix eastwoodiae* -- Cryaquoll -- Floodplain ecological type

Plant Code	Scientific Name	Percent Constancy	Cover Range	Similarity to PNC
Grasses				
MUFI	*Muhlenbergia filiformis*	60	1-5	Moderate
POPR	*Poa pratensis*	40	1-7	Moderate
DECE	*Deschampsia cespitosa*	40	3-5	HIgh
PHAL2	*Phleum alpinum*	40	1-3	High
HOBR2	*Hordeum brachyantherum*	30	1-5	Low
AGTH2	*Agrostis thurberiana*	30	1-3	Low
POCUE	*Poa cusickii*	20	1	High
PTKI	*Ptilagrostis kingii*	20	1-2	Low
Grasslikes				
CASC12	*Carex scopulorum*	80	3-40	High
JUOR	*Juncus orthophyllus*	70	1-10	Moderate
CASU7	*Carex subnigricans*	40	1-10	High
CANE2	*Carex nebrascensis*	40	1-30	High
ELPA6	*Eleocharis pauciflora*	40	1-8	Moderate
CASI2	*Carex simulata*	30	3-5	High
JUBA	*Juncus balticus*	30	1-8	Moderate
LUCO6	*Luzula comosa*	20	1-2	High
Forbs				
TRWO	*Trifolium wormskioldii*	80	1-6	Moderate
ASALA	*Aster alpigenus*	70	1-20	Low
ACMI2	*Achillea millefolium*	60	1-3	Low
POBI6	*Polygonum bistortoides*	60	1-39	Moderate
EPCI	*Epilobium ciliatum*	60	1-3	Moderate
MIPR	*Mimulus primuloides*	60	1-6	Moderate
SAOR2	*Saxifraga oregana*	50	1-29	Moderate
STLOL3	*Stellaria longipes*	50	1	High
TRLO	*Trifolium longipes*	50	1-5	Moderate
ASOC	*Aster occidentalis*	30	1-3	Low
SPRO	*Spiranthes romanzoffiana*	30	1	High
TAOF	*Taraxacum officinale*	30	1-3	Low
TRMO2	*Trifolium monanthum*	30	1-3	Moderate
GESI3	*Gentianopsis simplex*	20	1	Moderate
VERON	*Veronica spp.*	20	1	Moderate
GEMA4	*Geum macrophyllum*	20	1	Moderate
POGR9	*Potentilla gracilis*	20	1-3	Low
SPCA5	*Sphenosciadium capitellatum*	20	1-3	High
Shrubs				
SAEA	*Salix eastwoodiae*	60	6-65	High
SAPL2	*Salix planifolia*	40	6-57	High
SAOR	*Salix orestra*	40	4-15	High
SAGE2	*Salix geyeriana*	30	3-15	High
SALE	*Salix lemmonii*	30	1-20	High

***Salix eastwoodiae* -- Cryaquoll -- Floodplain**

Location _____

Field Recorders _____

Date _____ Frame Size: 20 X 20 cm

Use Moist Non-Meadow Indicator Values for Any Additional Species

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total
Species Indicating High Similarity to PNC																					
CASC12																					
SAEA																					
SAPL2																					
SAOR																					
STLOL3																					
DECE																					
PHAL2																					
Species Indicating Moderate Similarity to PNC																					
TRWO																					
JUOR																					
MUFI1																					
POBI6																					
EPCI																					
MIPR																					
SAOR2																					
Species Indicating Low Similarity to PNC																					
ASALA																					
ACMI2																					
ASOC																					
HOBR2																					
AGTH2																					
TAOF																					

Environmental Features

Scorecard Values:

Rooting Depth (cm) _____ (many, fine or very fine roots)

Rooting Depth (cm) _____ (common, fine or very fine roots)

Mapping Values:

Soil Taxa _____

Landform _____

Form # 17-2060-46 (9/98)

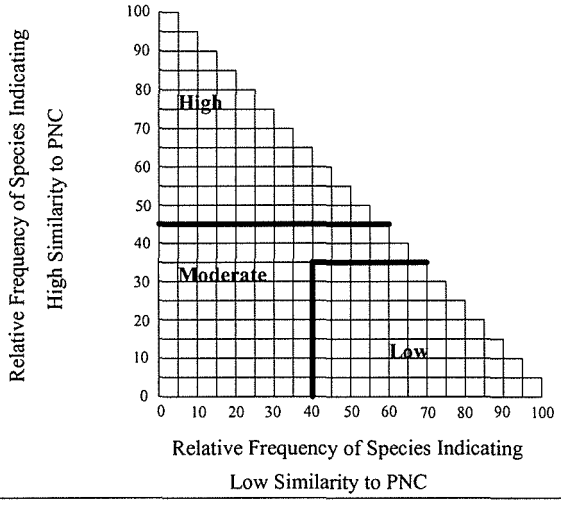
Salix eastwoodiae -- Cryaquoll -- Floodplain

Location: _____

Scorer: _____

Sample Date: _____

Vegetation similarity to PNC



Scorecard		
Ecological Status	Description	Notes
High Similarity to PNC	Vegetation has high similarity to PNC Rooting depth (many) 27 - 113 cm Rooting depth (common) 57 - 113 cm	
Moderate Similarity to PNC	Vegetation has moderate similarity to PNC Rooting depth (many) 8 - 26 cm Rooting depth (common) 29 - 56 cm	
Low Similarity to PNC	Vegetation has low similarity to PNC Rooting depth (many) 0 - 7 cm Rooting depth (common) 0 - 28 cm	

Warm willow -- Oxyaquic Cryorthent -- Gravel bar ecological type

WARM WILLOW/GRAVEL BAR ECOLOGICAL TYPE

Sample size = 9 plots

Photo - Plot 97812, Hope Valley

Landform and Setting

Gravel bars are the dominant (100%) landforms. The soils sampled in this type are recent and lack organic matter accumulation. Most soils are Cryorthents (67%). The average depth to saturation is 51 cm. Sites that key to this type are considered jurisdictional wetlands. Saturation and redoximorphic features occur in (33%) of the soils, making them Typic Cryaquents. Depth to coarse stream bed material averaged 42cm. Surface soil material is medium to fine sand with average grain sizes of D_{50} = 571 microns and D_{10} =135 microns. Elevation of sites ranges from 5800 to 7100 feet; yet soil temperatures are warm. At 50cm depth temperature averages 14 °C. Exposed environs or lack of shading helps gravel bars warm up more than surrounding landforms. Valley slope averages 2%, while lateral slope averages 4% and ranges up to 8% Slopes are less than those in the Warm willow -- Typic Cryaquent -- Floodplain ecological type. Sampled in the Walker and Carson rivers basins.

Description of Ecological Type Dynamics

Potential Natural Community (PNC) - Gravel bar communities have low basal cover of plant species. Even in sites with high similarity to PNC, basal cover rarely exceeds 15%. Foliar cover may reach 70%. Basal cover and rooting depth are good indicators of ecological status. Properly functioning sites in this type must have willow and herbaceous cover sufficient for dissipating the energy of flows and capturing water-borne soil material. Greater than 20% canopy cover of willow species such as *Salix exigua, Salix geyeriana* and *Salix lutea* of older age classes indicate site stability. Understory grasslikes indicate the moisture status of the site as well as site stability. Some of the species associated with high similarity to PNC are: *Carex nebrascensis, Carex athrostachya,* and *Carex lanuginosa.*

Disturbance Pathways - This landtype is continually scoured or built up by flooding events. Successional pathways are controlled both by fluvial processes and by the establishment of plant species that protect the site from scour or induce deposition of floodborne materials. Early colonizing grass species on gravel bars are: *Alopecurus aequalis, Hordeum brachyantherum, Hordeum jubatum, Bromus tectorum, Agrostis stolonifera* and *Agrostis scabra.* Young age classes of willows are common on newly formed gravel bars as well. Seed from adjacent and upstream riparian plant communities may germinate under favorable conditions. Willow seeds are viable for only a few days (George Argus, pers. comm.) and bare soil with the proper moisture is required for germination and survival. Establishment of willows can be enhanced by planting of cuttings and protection of seedlings and sprouts from overbrowsing by livestock. *Salix exigua* spreads aggressively by suckers and so is a good candidate species for cuttings. Stable gravel bars which are experiencing disturbance have niches for disturbance indicator forbs such as *Taraxacum officinale, Achillea millefolium, Iris missouriensis* and *Sidalcea oregana.*

Irregardless of ecological status, sites in this ecological type fit the criteria for jurisdictional wetlands. Efforts should be made to maintain and improve ecological function of these sites.

Cross References to Other Classifications

Warm Willow/Mesic Graminoid -- Cryofluvent -- Gravelbar ecological type (Weixelman et. al., 1996) This Central Nevada ecological type can be thought of as an association of the Sierran gravel bar and floodplain warm willow ecological types.

Montane Wetland Shrub Habitat (Sawyer and Keeler-Wolf, 1995) includes some sites that are in this ecological type, but also includes representatives of the Cold willow/Mesic graminoid ecological type, as well as types not described in this guide.

Narrowleaf Willow Series (Sawyer and Keeler-Wolf, 1995) includes some sites that are in this ecological type. The higher elevational extent of this series is included in this ecological type. The bulk of the series is located at elevations below this type and may be similar in many characteristics of environment and vegetation dynamics.

SAEX (c.t.?) (Smith, 1998 draft) represents part of this ecological type with low to moderate similarity to potential natural community.

SAGE/Grass (c.t.?)(Smith, 1998 draft) represents part of this ecological type with moderate similarity to potential.

SAGE/Mesic Graminoid (association?)(Smith, 1998 draft) has moderate to high similarity to potential in this ecological type.

SALE1/Fluvent c.t. (Smith, 1998 draft) represent low similarity to potential in this ecological type.

SALU/MG c.t. (Manning and Padgett, 1995) represents moderate to high similarity to potential in this ecological type due to the high cover of mesic graminoids in the understory.

SALU/POPR c.t. (Manning and Padgett, 1995) represents moderate similarity to potential since grasses are fairly dense and forbs have low cover.

SALIX/POPR c.t (Manning and Padgett, 1995) represents moderate similarity to potential since litter and graminoid cover are so high.

Characteristic Vegetation of the Warm willow -- Oxyaquic Cryorthent -- Gravel bar ecological type

Plant Code	Scientific Name	Percent Constancy	Cover Range	Similarity to PNC
Grasses				
POPR	*Poa pratensis*	100	1-15	Moderate
AGST2	*Agrostis stolonifera*	88	1-8	Low
ELTRT	*Elymus trachycaulus trachycaulus*	66	1-3	High
AGSC5	*Agrostis scabra*	55	1-8	Low
MURI	*Muhlenbergia richardsonis*	55	1-8	Moderate
BRTE	*Bromus tectorum*	33	1	Low
HOJU	*Hordeum jubatum*	33	1	Low
POSEJ	*Poa secunda ssp. juncifolia*	22	1-3	High
HOBR2	*Hordeum brachyantherum*	22	1	Low
POMO5	*Polypogon montspeliensis*	22	1	Low
LETR5	*Leymus triticoides*	22	8-70	Moderate
Grasslikes				
EQAR	*Equisetum arvense*	77	1-8	Low
JUBA	*Juncus balticus*	77	1-10	Moderate
CANE2	*Carex nebrascensis*	55	1-3	Moderate
CADO2	*Carex douglasii*	44	1-3	Moderate
CAAT3	*Carex athrostachya*	33	1	High
CALA30	*Carex lanuginosa*	33	1-8	High
ELPA6	*Eleocharis pauciflora*	33	1-3	Moderate
Forbs				
TAOF	*Taraxacum officinale*	66	1-3	Low
ACMI2	*Achillea millefolium*	55	1	Low
EPCI	*Epilobium ciliatum*	55	1-5	Moderate
TRWO	*Trifolium wormskioldii*	33	3-49	Moderate
ASOC	*Aster occidentalis*	33	1-6	Low
IRMI	*Iris missouriensis*	33	1	Low
VETH	*Verbascum thapsis*	33	1	Low
LULE2	*Lupinus lepidus*	22	1	Moderate
TRRE3	*Trifolium repens*	22	1-3	Low
SIOR	*Sidalcea oregana*	22	1	Low
POGL9	*Potentilla glandulosa*	22	1	Low
CIRSI	*Cirsium spp.*	22	1	Low
ARCHF	*Arnica chamissonis*	22	1	Low
ASFO	*Aster foliaceus*	22	1-3	Low
DESO2	*Descurianía sophia*	22	1	High
MEAL12	*Melilotus alba*	22	1-3	Low
Shrubs				
SALU2	*Salix lutea*	77	1-10	High
SAEX	*Salix exigua*	77	6-70	High
SAGE2	*Salix geyeriana*	33	3-10	High
ARCA13	*Artemisia cana*	33	1-3	High

Warm willow -- Oxyaquic Cryorthent -- Gravel bar

Location _____

Field Recorders _____

Date _____ Frame Size: 20 X 50 cm

Use Moist Non-Meadow Indicator Values for Any Additional Species

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	To-tal
Species Indicating High Similarity to PNC																					
SALU2																					
SAEX																					
ELTRT																					
CAAT3																					
CALA30																					
SAGE2																					
Species Indicating Moderate Similarity to PNC																					
POPR																					
JUBA																					
CANE2																					
MURI																					
EPCI																					
CADO2																					
ELPA6																					
Species Indicating Low Similarity to PNC																					
AGST2																					
EQAR																					
TAOF																					
AGSC5																					
ACMI2																					
BRTE																					
HOJU																					

Environmental Features

Scorecard Values:

Rooting Depth (cm) _____ (common, fine or very fine roots)

Basal cover of Vegetation _____

Mapping Values:

Soil Taxa _____

Landform _____

Form # 17-2060-48 (8/98)

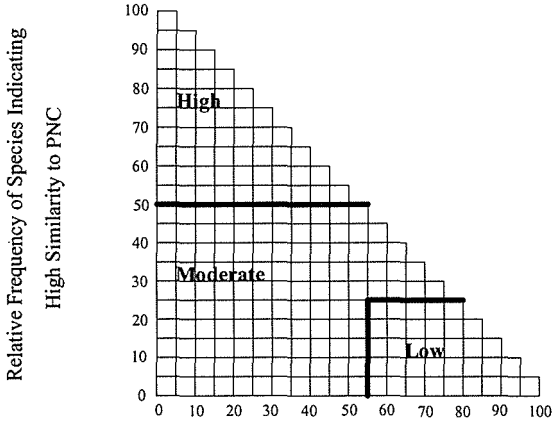
Warm willow -- Oxyaquic Cryorthent -- Gravel bar

Location: _____

Scorer: _____

Sample Date: _____

Vegetation similarity to PNC



Scorecard		
Ecological Status	Description	Notes
High Similarity to PNC	Vegetation has high similarity to PNC Rooting depth (common) 10 - 24 cm Basal cover of vegetation 9 - 15 %	
Moderate Similarity to PNC	Vegetation has moderate similarity to PNC Rooting depth (common) 3 - 9 cm Basal cover of vegetation 5 - 8 %	
Low Similarity to PNC	Vegetation has low similarity to PNC Rooting depth (common) 0 - 3 cm Basal cover of vegetation 0 - 4 %	

Form # 17-2060-49 (9/98)

Warm willow -- Typic Cryaquent -- Floodplain ecological type

WARM WILLOW/FLOODPLAIN ECOLOGICAL TYPE

Sample size = 10 plots

Photo - Plot 97768, Jackass Creek

Landform and Setting

This type is most common on floodplains (80%). The soils on these floodplains accumulate more fine sediments than on the gravelbars. Average soil surface material fine sand and silt, with D_{50} = 224 microns and D_{10} = 58 microns. On gravel bars these grain sizes were twice as large. Depth to coarse stream bed material was within a meter of the surface. Valley slope tends to be about 4%. Lateral slope averages 7%, but may be as steep as 27%. With better cover, soil temperatures were cooler on floodplains than on gravel bars. Soil temperature at 50cm depth averages 12 °C. Elevation range was 5400 to 7500 feet. Depth to saturation averages 48cm. Sites that key to this type are considered jurisdictional wetlands. Sixty percent of the soils sampled had both saturation and redoximorphic features within a meter of the surface. Most (80%) of the soils lacked the organic matter accumulation to be classed as Mollisols; the most common soils were Typic Cryaquents and Oxyaquic Cryofluvents. Sampled in the Walker and Truckee river watersheds.

Description of Ecological Type Dynamics

Potential Natural Community (PNC) - Functioning sites in this type are dominated by overstory cover of willows such as *Salix exigua, Salix lutea*, or *Salix lucida ssp. lasiandra* and a dense graminoid understory. Typically rhizomatous species such as *Carex nebrascensis*, *Carex lanuginosa* or a mixture of *Carex* species and *Juncus* species dominates the herbaceous layer. These species are capable of trapping fine sediments and building the floodplain. The species composition of the herbaceous layer provides information on the ecological status and sediment-trapping capability of the site.

Disturbance Pathways - Because surface soils are moist to wet for most of the growing season, these sites are susceptible to compaction from trampling by livestock or

recreationists. Trampling damage can break up rhizomes, weaken sedge vigor, and allow for the establisment of pioneer plant species such as *Poa pratensis, Juncus balticus, Iris missouriensis, Achillea millefolium* or *Aster occidentalis.*

Irregardless of ecological status, sites in this ecological type fit the criteria for jurisdictional wetlands. Efforts should be made to maintain and improve ecological function of these sites.

Cross References to Other Classifications

Warm Willow/Mesic Graminoid -- Cryofluvent -- Gravelbar ecological type (Weixelman et.al., 1996) *Rosa woodsii* is more prevalent in the Sierra Nevada than it was in Central Nevada. The Central Nevada type can be viewed as an association of the Sierran gravel bar and floodplain ecological types.

SALU/MG c.t. (Manning and Padgett, 1995) is a community type representing a range in ecological status within this ecological type.

SALU/MF c.t. (Manning and Padgett, 1995) represents moderate to high similarity to potential in this ecological type.

SALU/POPR c.t. (Manning and Padgett, 1995) represents moderate similarity to PNC.

SALIX/MG c.t. (Manning and Padgett, 1995) represents a community with moderate to low similarity to potential.

SALU/ROWO c.t. (Manning and Padgett, 1995) represents moderate similarity to PNC.

SAEX/ROWO c.t. (Manning and Padgett, 1995) represents moderate to high similarity to potential depending on the relative abundance of high status indicators such as *Elymus trachycaulus* and *Smilacina stellata.*

SALIX/POPR c.t. (Manning and Padgett, 1995) represents moderate to high ecological status in this ecologial type.

SAEX c.t. (Smith, 1998 draft) This plant community represents moderate ecological status due to indicator species such as *Rosa woodsii.*

ROWOU c.t. (Smith, 1998 draft) This is a low ecological status plant community in this or other ecological types.

SALU3/Grass c.t. (Smith, 1998 draft) This community type represents moderate to high similarity to PNC in this ecological type.

Montane Wetland Shrub Habitat (Sawyer and Keeler-Wolf, 1995) Some communities in this habitat are also examples of this ecological type with varying degrees of similarity to PNC.

Narrowleaf Willow Series (Sawyer and Keeler-Wolf, 1995) Sites in this series which meet the landform and soils criteria for this ecological type represent moderate to high similarity to PNC for this type.

Characteristic Vegetation of the Warm willow -- Typic Cryaquent -- Floodplain ecological type

Plant Code	Scientific Name	Percent Constancy	Cover Range	Similarity to PNC
Grasses				
POPR	*Poa pratensis*	88	3-50	Moderate
FERU2	*Festuca rubra*	55	1-3	Moderate
AGST2	*Agrostis stolonifera*	55	1-7	Low
ELTRT	*Elymus trachycaulus ssp. trachycaulus*	44	1-3	High
MUAS	*Muhlenbergia asperifolia*	33	1-2	Low
Grasslikes				
CANE2	*Carex nebrascensis*	88	1-40	High
JUBA	*Juncus balticus*	77	2-15	Moderate
CALA30	*Carex lanuginosa*	44	1-12	High
CAAU3	*Carex aurea*	33	1	High
CAMI7	*Carex microptera*	22	1	Moderate
JUNE	*Juncus nevadensis*	22	1	High
Forbs				
ACMI2	*Achillea millefolium*	77	1-3	Low
TAOF	*Taraxacum officinalis*	77	1-6	Low
ASOC	*Aster occidentalis*	66	1-10	Low
EPCI	*Epilobium ciliatum*	66	1-3	Moderate
EQAR	*Equisetum arvense*	66	1-8	Low
IRMI	*Iris missouriensis*	66	1-6	Low
VIAM	*Vicia americana*	66	1-8	Low
ARMO4	*Arnica mollis*	55	1-3	Moderate
TRLO	*Trifolium longipes*	44	1-8	Moderate
TRWO	*Trifolium wormskioldii*	33	1-13	Moderate
AQFO	*Aquilegia formosa*	33	1-3	High
STLOL	*Stellaria longipes var. longipes*	33	1	High
VIAD	*Viola adunca*	33	1	Moderate
POGR9	*Potentilla gracilis*	22	1	Low
MEAR4	*Mentha arvensis*	22	1-3	Moderate
ASAS5	*Aster ascendens*	22	1	Low
GEMA4	*Geum macrophyllum*	22	1-6	Moderate
CIDO	*Cicuta douglasii*	22	1-9	Moderate
PLMA2	*Plantago major*	22	1	Low
SMST	*Smilacina stellata*	22	1	High
VESEH	*Veronica sepyllifolia ssp. humifusa*	22	1-3	Moderate
Shrubs				
SAEX	*Salix exigua*	88	5-60	High
SALU2	*Salix lutea*	44	3-45	High
SALUL	*Salix lucida lasiandra*	33	5-30	High
SAGE2	*Salix geyeriana*	22	6-13	High
ROWOU	*Rosa woodsii var. ultramontana*	66	1-35	Moderate
SHAR	*Sheperdia argentia*	22	10-15	Moderate

Warm willow -- Typic Cryaquent -- Floodplain

Location _____

Field Recorders _____

Date _____ Frame Size: 20 X 20 cm

Use Moist Non-Meadow Indicator Values for Any Additional Species

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total
Species Indicating High Similarity to PNC																					
CANE2																					
SAEX																					
SALU2																					
ELTRT																					
CALA30																					
AQFO																					
Species Indicating Moderate Similarity to PNC																					
POPR																					
JUBA																					
EPCI																					
ROWOU																					
FERU2																					
ARMO4																					
TRLO																					
Species Indicating Low Similarity to PNC																					
ACMI2																					
TAOF																					
ASOC																					
EQAR																					
IRMI																					
VIAM																					
AGST2																					

Environmental Features

Scorecard Values:

Rooting Depth (cm) _____ (many, fine or very fine roots)

Rooting Depth (cm) _____ (common, fine or very fine roots)

Mapping Values:

Soil Taxa _____

Landform _____

Form # 17-2060-50 (9/98)

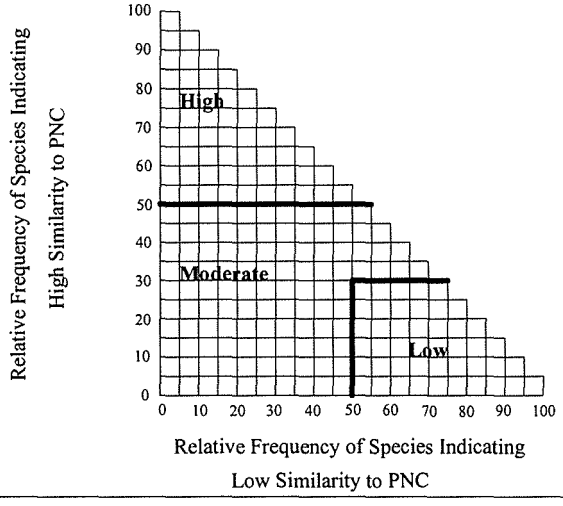
Warm willow -- Typic Cryaquent -- Floodplain

Location: _____

Scorer: _____

Sample Date: _____

Vegetation similarity to PNC



Scorecard		
Ecological Status	Description	Notes
High Similarity to PNC	Vegetation has high similarity to PNC Rooting depth (many) 13 - 23 cm Rooting depth (common) 33 - 51 cm	
Moderate Similarity to PNC	Vegetation has moderate similarity to PNC Rooting depth (many) 8 - 12 cm Rooting depth (common) 22 - 32 cm	
Low Similarity to PNC	Vegetation has low similarity to PNC Rooting depth (many) 0 - 7 cm Rooting depth (common) 0 - 21 cm	

Cold willow/Mesic graminoid -- Cryaquoll -- Floodplain ecological type

Sample size = 28 plots

Photo - Plot 96748, Franktown Creek

Landform and Setting

Low gradient meadow systems with willow overstories. Valley slopes average 2% and lateral slopes average 4%. Floodplains are the dominant landform (61%). This type is also common on gravel bars (21%). Coarse texture surface soils are typical. Average D_{50} = 808 microns and D_{10} = 104 microns. This type lacks the silt deposition found in the Warm willow/Floodplain type. Depth to saturation averages 38cm. Mottles are common. Depth to field capacity averages 19cm. Sites that key to this type are considered jurisdictional wetlands. Soil temperature averages 10 °C at 50cm. Elevations range from 5800 to 9200ft. This type is often found in cold air drainage areas within the elevation band of the Warm willow types. The most common soil classification was Typic Cryaquoll (32%). Several sites lacked the organic matter accumulation to be Mollisols; they have Cryaquents and Cryofluvents. This type occurred throughout the Walker, Carson and Truckee watersheds.

Description of Ecological Type Dynamics

Potential Natural Community (PNC) - Plant communities in this type are dominated by an overstory of *Salix boothii, Salix lemmonii*, or *Salix geyeriana* with a dense understory of graminoid species. Typically, *Carex nebrascensis, Carex lanuginosa, Deschampsia*

cespitosa or *Phleum alpinum* dominate the herbaceous layer. The species composition of the herbaceous layer provides information on ecological status, function and condition. These sites have a high potential for providing stable streambanks and controlling surface erosion, providing that willow species are allowed to establish and a dense graminoid herbaceous layer is present. These vegetation features increase roughness and allow for capture of fine sediments and energy dissipation of flood flows.

Disturbance Pathways - Because surface soils are moist to wet for most of the growing season, these sites are susceptible to compaction from trampling by livestock or recreationists. Early spring grazing should be minimized or avoided to maintain soil stability and sedge cover. Plant species indicating low similarity to PNC which may indicate loss of site function are: *Poa pratensis, Juncus balticus, Potentilla gracilis, Aster occidentalis* or *Achillea millefolium.*

Irregardless of ecological status, sites in this ecological type fit the criteria for jurisdictional wetlands. Efforts should be made to maintain and improve ecological function of these sites.

Cross References to Other Classifications

Salix geyeriana/Mesic Graminoid -- Cryaquoll -- Alpine trough floodplain ecological type (Weixelman et.al., 1996) This ecological type from Central Nevada was colder than this Sierran ecological type although species composition was very similar.

Cold Willow/Mesic Graminoid -- Cryaquoll -- Trough floodplain ecological type (Weixelman et.al., 1996) This ecological type from Central Nevada was also colder than the Sierran ecological type setting. *Salix boothii* and *Salix boothii* x *lutea* were both common dominants in Central Nevada, while *Salix geyeriana* and *Salix lemmonii* were more common in the Sierra Nevada.

SALE1/MGRAM c.t. (Smith, 1998 draft) This is one of the communities with high similarity to PNC within this ecological type.

SAGE/MGRAM c.t. (Smith, 1998 draft) This community type represents high similarity to PNC.

SAGE/GRASS c.t. (Smith, 1998 draft) This community type represents moderate to low ecological status due to understory species with moderate or low similarity to PNC.

SALE/CASC c.t. (Manning and Padgett, 1995) represents high similarity to PNC.

SALE/MG c.t. (Manning and Padgett, 1995) represents high or moderate similarity to potential depending on which graminoid indicator species are present.

SAGE/MG c.t. (Manning and Padgett, 1995) represents high or moderate similarity to potential depending on which graminoid indicator species are present.

SALE/MF c.t. (Manning and Padgett, 1995) high cover of mesic forbs indicates fairly high ecological status.

Characteristic Vegetation of the Cold willow/Mesic graminoid -- Cryaquoll -- Floodplain ecological type

Plant Code	Scientific Name	Percent Constancy	Cover Range	Similarity to PNC
Grasses				
POPR	*Poa pratensis*	78	1-51	Moderate
DECE	*Deschampsia cespitosa*	32	1-10	High
PHAL2	*Phleum alpinum*	32	1-4	High
HOBR2	*Hordeum brachyantherum*	28	1-6	Low
MURI	*Muhlenbergia richardsonis*	25	1-15	Moderate
FERU2	*Festuca rubra*	25	1-12	Moderate
MUFI1	*Muhlenbergia filiformis*	17	1-10	Moderate
GLEL	*Glyceria elata*	17	1-15	High
Grasslikes				
CANE2	*Carex nebrascensis*	67	1-45	High
JUBA	*Juncus balticus*	64	1-12	Moderate
CAMI7	*Carex microptera*	42	1-17	Moderate
JUOR	*Juncus orthophyllus*	39	1-4	Moderate
CALA30	*Carex lanuginosa*	35	1-25	High
EQAR	*Equisetum arvense*	32	1-5	Low
CASC12	*Carex scopulorum*	28	1-27	High
CAAT3	*Carex athrostachya*	25	1-3	High
JUNE	*Juncus nevadensis*	25	1-6	High
CAVE6	*Carex vesicaria*	17	1-25	High
JUCOO	*Juncus covillei*	17	1-4	Moderate
CAAU3	*Carex aurea*	17	1-4	High
CASI2	*Carex simulata*	17	1-15	High
Forbs				
ACMI2	*Achillea millefolium*	75	1-5	Low
ASOC	*Aster occidentalis*	67	1-8	Low
TAOF	*Taraxacum officinale*	64	1-8	Low
GEMA4	*Geum macrophyllum*	53	1-5	Moderate
TRLO	*Trifolium longipes*	50	1-20	Moderate
POGR9	*Potentilla gracilis*	46	1-10	Low
EPCI	*Epilobium ciliatum*	42	1-7	Moderate
TRMO2	*Trifolium monanthum*	39	2-53	Moderate
STLOL3	*Stellaria longipes*	35	1	High
POBI6	*Polygonum bistortoides*	21	1-6	Moderate
MIGU	*Mimulus guttatus*	25	1-3	Moderate
ARCHF	*Arnica chamissonis*	21	1-3	Low
MOCH	*Montia chamissoi*	21	1-3	Moderate
POOC2	*Polemonium occidentale*	17	1-8	Moderate
GALIU	*Galium spp.*	17	1-3	Moderate
Shrubs				
SAGE2	*Salix geyeriana*	67	1-38	High
SALE	*Salix lemmonii*	50	2-95	High
SABO2	*Salix boothii*	39	1-53	High
RIIN2	*Ribes inerme*	32	1-32	High

Cold willow/Mesic graminoid --Cryoaquoll -- Floodplain

Location _____

Field Recorders _____

Date _____ Frame Size: 20 X 20 cm

Use Mesic Non-Meadow Indicator Values for Any Additional Species

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total
Species Indicating High Similarity to PNC																					
CANE2																					
SAGE2																					
SALE																					
SABO2																					
CALA30																					
STLOL3																					
Species Indicating Moderate Similarity to PNC																					
POPR																					
JUBA																					
GEMA4																					
TRLO																					
CAMI7																					
EPCI																					
Species Indicating Low Similarity to PNC																					
ACMI2																					
ASOC																					
TAOF																					
POGR9																					
EQAR																					

Environmental Features

Scorecard Values:

Rooting Depth (cm) _____ (many, fine or very fine roots)

Rooting Depth (cm) _____ (common, fine or very fine roots)

Litter cover _____

Color value of the A horizon dry _____

Mapping Values:

Soil Taxa _____

Landform _____

Form # 17-2060-52 (9/98)

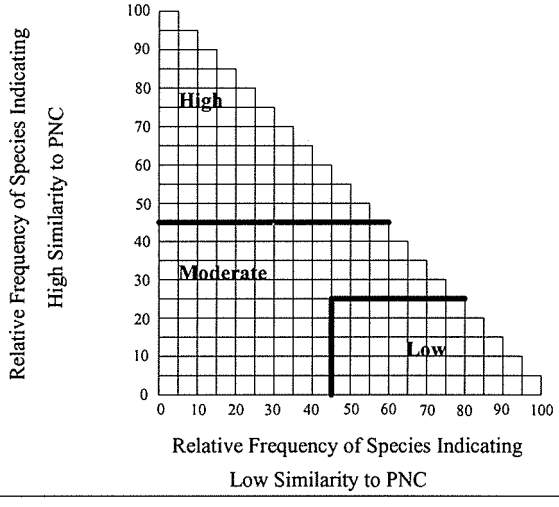
Cold willow/Mesic graminoid -- Cryaquoll -- Floodplain

Location: _____

Scorer: _____

Sample Date: _____

Vegetation similarity to PNC



Scorecard		
Ecological Status	Description	Notes
High Similarity to PNC	Vegetation has high similarity to PNC Rooting depth (common) 43 - 78 cm Rooting depth (many) 15 - 46 cm Litter cover 81 - 98 % Color value of soil A horizon dry is 4	
Moderate Similarity to PNC	Vegetation has moderate similarity to PNC Rooting depth (common) 28 - 42 cm Rooting depth (many) 5 - 14 cm Litter cover 54 - 80 % Color value of soil A horizon dry is 4	
Low Similarity to PNC	Vegetation has low similarity to PNC Rooting depth (common) 0 - 27 cm Rooting depth (many) 0 - 4 cm Litter cover 0 - 53 % Color value of soil A horizon dry is 5	

Cold willow/Mesic forb -- Haplocryoll -- Floodplain ecological type

Sample size = 4 plots

Landform and Setting

Steep gradient systems with willow overstories and herbaceous understories. Valley slopes average 8% and lateral slopes average 8%. Floodplains are the dominant landform (61%). Coarse texture surface soils are typical. Average D_{50} = 808 microns and D_{10} = 104 microns. This type lacks the silt deposition found in the Warm willow/Floodplain type. Depth to saturation averages 38cm. Mottles are common. Depth to field capacity averages 19cm. With appropriate vegetation, saturation and hydric soils, all sites in this type are jurisdictional wetlands. Soil temperature averages 10 °C at 50cm. Elevations range from 5800 to 9200ft. This type is often found in cold air drainage areas within the elevation band of the Warm willow types. The most common soil classification was Typic Cryaquoll (32%). Several sites lacked the organic matter accumulation to be Mollisols; they have Cryaquents and Cryofluvents. This type occurred throughout the Walker, Carson and Truckee watersheds.

Description of Ecological Type Dynamics

Potential Natural Community (PNC) - Communities with high similarity to PNC have an overstory of cold willows (*Salix boothii, Salix lemmonii, Salix geyeriana*) with a herbaceous layer of forb and graminoid species. Typically, tall forbs such as *Aconitum columbianum, Aquilegia formosa*, or *Smilacina stellata* dominate the herbaceous layer. *Carex spp.* and other graminoids are also present. The species composition of the herbaceous layer provides information on the successional stage and health of a site. These sites have moderate potential for providing stable streambanks and controlling surface erosion if a healthy willow stand is present and there is moderate to dense cover of forbs and graminoids in the understory. It is important to maintain cover of willows on these sites because willow species provide the root systems necessary for stable streambanks. Additionally, tall forbs tend to require shading, moisture and protection provided by the shrub canopy.

Disturbance Pathways - Because surface soils are moist to wet for most of the growing season, these sites are susceptible to compaction from trampling. *Rosa woodsii* increases with disturbance on these sites. Sites in this type may have once been on floodplains with more soil moisture and graminoid species in the herbaceous layer. However, incision of the stream or lateral migration of the stream has caused a drop in the water table and an increase in tall forb cover. Disturbance species are *Rosa woodsii* and *Ribes spp.* in the shrub layer and *Poa pratensis, Juncus balticus, Potentilla gracilis, Geum macrophyllum* or *Achillea millefolium* are typically present on sites that are heavily grazed and/or compacted.

Irregardless of ecological status, sites in this ecological type fit the criteria for jurisdictional wetlands. Efforts should be made to maintain and improve ecological function of these sites.

This ecological type is relatively protected from the detrimental effects of most landuses, due to its setting along steeper stream reaches. Because this type is less at risk than many others, we did not focus sampling on this ecological type. We did not visit enough sites in this type to develop a scorecard.

Cross References to Other Classifications

Cold Willow/Mesic Forb -- Cryaquoll -- Trough stream terrace ecological type (Weixelman et.al., 1996) This ecological type from Central Nevada was found in colder environments that its Sierran counterpart. *Salix lemmonii* dominated in the Sierra while *Salix boothii* and *Salix lutea* were more common in Central Nevada.

SALE/MF c.t. (Manning and Padgett, 1995) Ecological status in this community type varies from moderate to high depending on the composition of the understory forb layer.

SALIX/MF c.t. (Manning and Padgett, 1995) The mesic forbs in this community type are indicators of moderate to high ecological status.

SALE/TF (Manning and Padgett, 1995) This drier community represents low to moderate ecological status in this ecological type.

SALE1/DRY GRAMINOID c.t. (Smith, 1998 draft) This community represents low similarity to PNC and low ecological status

SALE1/MESIC FORB c.t. (Smith, 1998 draft) This community expresses high similarity to PNC.

Characteristic Vegetation of the Cold willow/Mesic forb -- Cryaquoll -- Floodplain ecological type

Plant Code	Scientific Name	Percent Constancy	Cover Range	Similarity to PNC
Grasses				
POPR	*Poa pratensis*	75	1-12	Moderate
FERU2	*Festuca rubra*	75	1	Moderate
ELTRT	*Elymus trachycaulus*	75	1	High
BRAN	*Bromus anomalus*	75	1	Moderate
ACOCC	*Achnatherum occidentalis ssp. californicum*	50	1	Moderate
ELGL	*Elymus glaucus*	50	1	Moderate
CACA4	*Calamagrostis canadensis*	50	1	High
POCU3	*Poa cusickii*	25	1-3	High
STNE3	*Achnatherum nelsonii*	25	1-2	Moderate
HOBR2	*Hordeum brachyantherum*	25	1-2	Low
Grasslikes				
CAMI7	*Carex microptera*	75	1-2	Moderate
CASC12	*Carex scopulorum*	25	1	High
CAAT3	*Carex athrostachya*	25	1	High
Forbs				
OSCH	*Osmorhiza chilensis*	75	1-5	High
HELA4	*Heracleum lanatum*	75	1-5	High
ACMI2	*Achillea millefolium*	75	1-3	Low
LIGR	*Ligusticum grayi*	75	1-2	Moderate
ASOC	*Aster occidentalis*	75	1	Low
TAOF	*Taraxacum officinale*	75	1	Low
TRLO	*Trifolium longipes*	75	1	Moderate
THSP	*Thalictrum sparsiflorum*	50	2-10	Moderate
POGR9	*Potentilla gracilis*	50	1-5	Low
ARDR	*Arabis drummondii*	50	1	Low
POOC2	*Polemonium occidentale*	50	1	Moderate
Shrubs				
SALE	*Salix lemmonii*	75	55-68	High
RIIN2	*Ribes inerme*	75	8-18	High
SAGE2	*Salix geyeriana*	25	65	High
SABO2	*Salix boothii*	25	9	High
SYRO	*Symphoricarpos rotundifolius*	25	4	High

***Populus tremuloides*/Mesic Graminoid -- Haplocryoll -- Floodplain and stream terrace ecological type**

QUAKING ASPEN/MESIC GRAMINOID ECOLOGICAL TYPE

Sample size = 10 plots

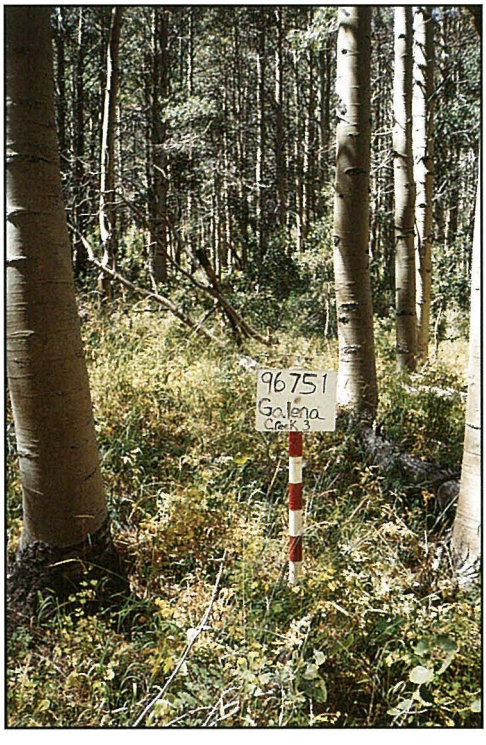


Photo - Plot 96751, Galena Creek

Landform and Setting

Aspen sites with graminoid dominated understories due to soil moisture at field capacity close to the surface. Average depth to field capacity is 27cm. Commonly found on trough floodplains (50%) and stream terraces (40%). The aspen overstory may extend away from the riparian areas up onto hillslopes. Riparian aspen is distinguished from the hillslope aspen by the lower frequency of thick (pachic or cumulic) dark surface soils and by the presence of coarse streambed layers in the soil profile. Surface soil is medium to fine sand textured. Average grain sizes are D_{50} = 599 microns and D_{10} = 115 microns. Valley slope averages 6% while lateral slope averages 7%. Soil temperature at 50cm depth averages 9 °C. The most common soil is a Haplocryoll (80%). Sampled in the Walker and Truckee river watersheds at elevations ranging from 7100 to 8500 feet.

Description of Ecological Type Dynamics

Potential Natural Community (PNC) - Mixed age classes of aspen with multiple understory layers characterize stand with high similarity to PNC in this ecological type. Alders *(Alnus spp.*), Willows (*Salix spp.*) and snowberry (*Symphoricarpos spp.*) are common shrub understory components. Graminoid species that indicate high similarity to PNC include *Glyceria elata, Elymus glaucus, Carex lanuginosa, Carex nebrascensis* and *Carex nervina*. Relatively dense graminoid understory results in rooting characteristics that indicate good site health. Additionally, the rooting density coupled with high litter production, results in favorably high infiltration rates.

Disturbance Pathways - Periodic disturbance is necessary to maintain sites in high vigor. Cover of aspen is probably influenced by seasonal flooding and soil moisture. During wet years, these sites may be saturated for long periods retarding encroachment of aspen. Conversely, during drier years, aspen may encroach (and increase in cover) on these sites. On sites where the water table is lowered, white fir or lodgepole pine may replace aspen. Historically, fire probably helped maintain aspen on some sites. Beaver periodically renew aspen stands. As long as beaver populations are not too dense, aspen sites recover between periods of beaver colonization.

Cross References to Other Classifications

Populus tremuloides/Symphoricarpos spp. -- Pachic Cryoboroll -- Trough floodplain ecological type (Weixelman et.al., 1996) The Central Nevadan ecological type represents a wider range in moisture values; the Sierran type is the moister end of that spectrum.

Aspen Series (Sawyer and Keeler-Wolf, 1995) Some of the communities in this series fall within this ecological type. Review landform, setting and plant composition to determine whether a given site is in this ecological type.

POTR3/SYRO c.t. (Smith, 1998 draft) is a community with high similarity to PNC.

POTR3/MFORB c.t. (Smith, 1998 draft) Although this community is characterized by showy forbs, they indicate the moist conditions found in this ecological type as opposed to the Quaking Aspen/Tall Forb ecological type. Usually graminoid understory species have high enough cover for these sites to represent moderate to high similarity to PNC in this type.

POTR3/POPR1 c.t. (Smith, 1998 draft) This community type represents low to moderate similarity to PNC in this or the Quaking Aspen/Tall Forb ecological type.

POTR/POPR c.t. (Manning and Padgett, 1995) This community represents moderate similarity to PNC due to high cover of *Poa pratensis*.

POTR/MF c.t. (Manning and Padgett, 1995) Ecological status is dependent on forb composition. This community represents moderate similarity to PNC when there is high cover of moderate indicators such as *Veratrum californicum* and *Poa pratensis*.

ALIN/BENCH c.t. (Manning and Padgett, 1995) These communities associated with fault-line springs may fall within this ecological type especially when aspen and alder codominate the overstory.

Characteristic Vegetation of the *Populus tremuloides*/Mesic graminoid -- Haplocryoll -- Floodplain and Stream terrace ecological type

Plant Code	Scientific Name	Percent Constancy	Cover Range	Similarity to PNC
Grasses				
POPR	*Poa pratensis*	80	4-45	Moderate
ELGL	*Elymus glaucus*	80	1-46	Moderate
GLEL	*Glyceria elata*	30	1-14	High
Grasslikes				
CAMI7	*Carex microptera*	50	2-15	Moderate
CALA30	*Carex lanuginosa*	50	1-60	High
SCMI2	*Scripus microcarpus*	20	1-5	Moderate
CANE5	*Carex nervina*	20	3-5	High
Forbs				
TAOF	*Taraxacum officianale*	80	1-4	Low
EQAR	*Equisetum arvense*	70	1-11	Low
ACMI2	*Achillea millefolium*	50	1-3	Low
HELA4	*Heracleum lanatum*	50	1-8	High
AQFO	*Aquilegia formosa*	50	1-6	High
ERPE3	*Erigeron pereginus*	50	1-6	Moderate
THSP	*Thalictrum sparsiflorum*	50	1-30	Moderate
VIAM	*Vicia americana*	50	1-6	Low
SPCA5	*Sphenosciadium capitellatum*	40	1-3	High
GEMA4	*Geum macrophyllum*	40	1	Moderate
ASOC	*Aster occidentalis*	40	1-6	Low
CAMI12	*Castilleja miniata*	40	1-3	Moderate
LUPO2	*Lupinus polyphyllus*	40	1-2	Moderate
GALIU	*Galium spp.*	30	1-8	Moderate
SETR	*Senecio triangularis*	30	1	Low
ACCO4	*Aconitum columbianum*	20	2-3	High
LIGR	*Ligusticum grayi*	20	2-10	Moderate
ANBR5	*Angelica brewerii*	20	3-6	Moderate
TRWO	*Trifolium wormskioldii*	20	1-2	Moderate
VECAC-2	*Veratrum californicum var. californicum*	20	8-10	Moderate
POGL9	*Potentilla glandulosa*	20	1-3	Low
Shrubs				
SALE	*Salix lemmonii*	50	1-60	High
RIIN2	*Ribes inerme*	50	1-8	High
ALINT	*Alnus incana ssp. tenuifolia*	20	30-55	High
SAGE2	*Salix geyeriana*	20	5-6	High
SYRO	*Symphoricarpos rotundifolia*	20	1	High
Trees				
POTR5	*Populus tremuloides*	100	7-65	High
ABCO	*Abies concolor*	30	1-13	High
PICOM4	*Pinus contorta ssp. murrayana*	30	1-4	High

***Populus tremuloides*/Mesic graminoid --Haplocryoll -- Floodplain and Stream terrace**

Location _____

Field Recorders _____

Date _____ Frame Size: 20 X 50 cm

Use Moist Non-Meadow Indicator Values for Any Additional Species

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total
Species Indicating High Similarity to PNC																					
POTR5																					
SALE																					
RIIN2																					
HELA4																					
AQFO																					
CALA30																					
Species Indicating Moderate Similarity to PNC																					
POPR																					
ELGL																					
CAMI7																					
ERPE3																					
THSP																					
Species Indicating Low Similarity to PNC																					
TAOF																					
EQAR																					
ACMI2																					
VIAM																					
ASOC																					
SETR																					

Environmental Features

Scorecard Values:

Rooting Depth (cm) _____ (many, fine or very fine roots)

Infiltration rate (ml/5min.) _____

Percent cover of Basal Vegetation _____

Mapping Values:

Soil Taxa _____

Landform _____

Form # 17-2060-54 (9/98)

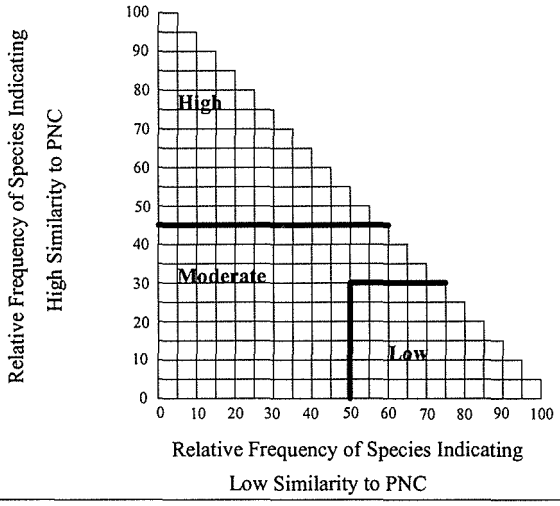
Populus tremuloides/Mesic graminoid - Haplocryoll - Floodplain and Stream terrace

Location: _____

Scorer: _____

Sample Date: _____

Vegetation similarity to PNC



Scorecard		
Ecological Status	Description	Notes
High Similarity to PNC	Vegetation has high similarity to PNC Rooting depth (common) 40 - 58 cm Infiltration rate (ml/5 min.) 17,983 - 20,000 Percent cover of basal vegetation 9 - 16 %	
Moderate Similarity to PNC	Vegetation has moderate similarity to PNC Rooting depth (common) 27 - 39 cm Infiltration rate (ml/5 min.) 12,383 - 17,982 Percent cover of basal vegetation 5 - 8 %	
Low Similarity to PNC	Vegetation has low similarity to PNC Rooting depth (common) 0 - 26 cm Infiltration rate (ml/5 min.) 0 - 12,382 Percent cover of basal vegetation 0 - 4 %	

***Populus tremuloides*/Tall forb -- Cumulic Haplocryoll -- Trough floodplain ecological type**

QUAKING ASPEN/TALL FORB ECOLOGICAL TYPE

Sample size = 9 plots

Landform and Setting

Aspen sites with forb dominated understories due to soil moisture being deeper in the soil profile. Average depth to field capacity is 53cm. Commonly found on trough floodplains (67%). This type is more similar to hillslope aspen types than is the Quaking aspen/Mesic graminoid type. Like hillslope aspen this type tends to have thick dark surface horizons. Two thirds of the sites sampled had cumulic or pachic mollic epipedons. Unlike hillslope aspen all the riparian sites had coarse streambed layers within the soil profile. Surface soil material is fine sand and silt textured. Average grain sizes are D_{50} = 347 microns and D_{10} = 71 microns. Valley slope averages 8% while lateral slope averages 9%. Soil temperature at 50cm depth averages 10 °C. The most common soil is a Haplocryoll (78%). Sampled in the Walker and Truckee river watersheds at elevations ranging from 6700 to 8700 feet.

Description of Ecological Type Dynamics

Potential Natural Community (PNC) - Aspen forms moderate to dense cover on these sites with alder sometimes sharing the overstory. The undergrowth is characterized by a moderate to dense cover of shrubs and/or tall forbs. Shrub species include *Symphoricarpos rotundifolia, Cornus sericea, Salix boothii* or *Ribes spp.* Tall forbs indicating high similarity to PNC are: *Osmorhiza chilensis, Sphenosciadium capetellatum* and *Aquilegia formosa.*

Disturbance Pathways - These sites are vulnerable to soil compaction and disturbance by campgrounds, trails and livestock. These sites have a moderate potential for providing stable streambanks. On sites where the water table is lowered and/or stream incision has occurred, white fir or lodgepole pine may encroach on aspen. Historically, fire probably helped maintain aspen on some sites. Fire may be used to rejuvenate and maintain aspen dominance, but will also maintain *Rosa woodsii*, also a root-sprouting species. Although a disturbance indicator, *Rosa woodsii* is important for stabilizing soils, particularly exposed streambanks composed of unconsolidated alluvium.

Cross References to Other Classifications

Populus tremuloides/Symphoricarpos spp. -- Pachic Cryoboroll -- Trough floodplain ecological type (Weixelman et.al., 1996) The Central Nevada aspen ecological type represents a wider range in moisture conditions. The Sierran type is the drier end of the spectrum.

POTR3/POPR1 c.t. (Smith, 1998 draft) is a community representing low to moderate similarity to PNC in this ecological type or in the Quaking Aspen/Mesic Graminoid ecological type.

POTR3/MFORB c.t. (Smith, 1998 draft) This community represents moderate to high similarity to PNC in this ecological type.

POTR3/SYRO c.t. (Smith, 1998 draft) This community represents moderate to high similarity to PNC in this ecological type.

ALINT/BENCH c.t. (Manning and Padgett, 1995) This community represents low to moderate similarity to PNC due to annual scouring/deposition resulting in low cover of graminoid and forb species.

Characteristic Vegetation of the *Populus tremuloides*/Tall forb -- Cumulic Haplocryoll -- Trough floodplain ecological type

Plant Code	Scientific Name	Percent Constancy	Cover Range	Similarity to PNC
Grasses				
POPR	*Poa pratensis*	75	1-23	Moderate
ELEL5	*Elymus elymoides*	25	1	Low
BRAN	*Bromus anomalus*	12	4	Moderate
MEHA2	*Melica hartfordii*	12	5	Low
DAGL	*Dactylis glomerata*	12	6	Low
AGEX	*Agrostis exarata*	12	1	Low
Grasslikes				
CAMI7	*Carex microptera*	25	1-4	Moderate
CALA30	*Carex lanuginosa*	25	3-11	High
Forbs				
OSCH	*Osmorhiza chilensis*	62	1-9	High
DECA6	*Descurania californicum*	37	1-3	Low
ALBIB	*Allium bisceptrum var. bisceptrum*	25	1-2	Moderate
VIAM	*Vicia americana*	37	1	Low
ACMI2	*Achillea millefolium*	12	5	Low
MOODP	*Monardella odoratissima ssp. pallida*	12	1	Moderate
GEMA4	*Geum macrophyllum*	12	3	Moderate
CISC2	*Cirsium scariosum*	12	1	Moderate
HAFL2	*Hackelia floribunda*	12	1	Low
TRIFO	*Trifolium spp.*	12	1	Moderate
Shrubs				
SASC	*Salix scouleriana*	37	1-2	High
SABO2	*Salix boothii*	37	1-22	High
SYRO	*Symphoricarpos rotundifolia*	37	1-16	High
RIIN2	*Ribes inerme*	37	1-21	High
ROWOU	*Rosa woodsii var. ultramotana*	37	1-3	Moderate
ALINT	*Alnus incana ssp. tenuifolia*	25	4-20	High
COSE16	*Cornus sericea*	25	2-15	High
AMALS	*Amelanchier alnifolia var. semiintegrifolia*	12	1	High
RICEC2	*Ribes cereum*	12	14	Moderate
ARTRT	*Artemisia tridentata tridentata*	12	1	High
ARTRV	*Artemisia tridentata vaseyana*	12	1	High
Trees				
POTR5	*Populus tremuloides*	100	2-71	High
ABCO	*Abies concolor*	25	1-34	High
PIJE	*Pinus jeffreyi*	25	1-22	High

***Populus tremuloides*/Tall forb -- Cumulic Haplocryoll -- Trough floodplain**

Location _____

Field Recorders _____

Date _____ Frame Size: 20 X 50 cm

Use Dry Non-Meadow Indicator Values for Any Additional Species

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	To-tal
Species Indicating High Similarity to PNC																					
POTR5																					
OSCH																					
SASC																					
SABO2																					
SYRO																					
Species Indicating Moderate Similarity to PNC																					
POPR																					
ROWOU																					
ALBIB																					
CAMI7																					
BRAN																					
TRIFO																					
Species Indicating Low Similarity to PNC																					
DECA6																					
VIAM																					
MEHA2																					
AGEX																					
HAFL																					
ACMI2																					

Environmental Features

Scorecard Values:

Infiltration rate (ml/5min)

Moist soil color value of the A horizon _____

Rooting Depth (cm) _____ (common, fine or very fine roots)

Mapping Values:

Soil Taxa _____

Landform _____

Form # 17-2060-56 (9/98)

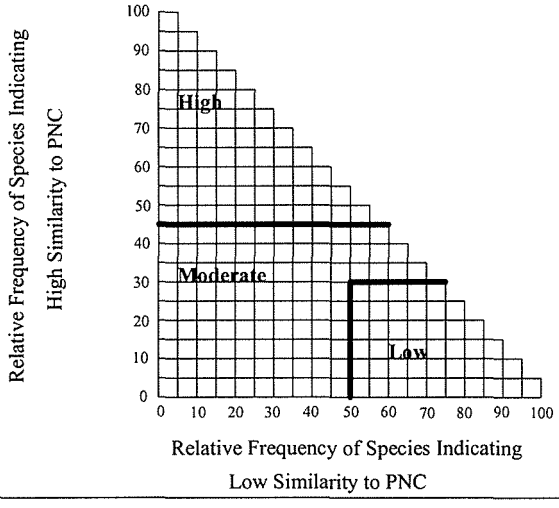
Populus tremuloides/Tall forb - Cumulic Haplocryoll - Trough floodplain

Location: _____

Scorer: _____

Sample Date: _____

Vegetation similarity to PNC



Scorecard		
Ecological Status	Description	Notes
High Similarity to PNC	Vegetation has high similarity to PNC Rooting depth (common) 44 -110 cm Infiltration rate (ml/5 min.) 7451 - 20,000 Moist soil color value of A horizon is 2	
Moderate Similarity to PNC	Vegetation has moderate similarity to PNC Rooting depth (common) 17 - 43 cm Infiltration rate (ml/5 min.) 4560 - 7450 Moist soil color value of A horizon is 2	
Low Similarity to PNC	Vegetation has low similarity to PNC Rooting depth (common) 0 - 16 cm Infiltration rate (ml/5 min.) 0 - 4559 Moist soil color value of A horizon is 3	

***Pinus contorta ssp. murrayana*/Mesic graminoid -- Haplocryoll -- Stream terrace and Floodplain ecological type**

LODGEPOLE PINE/MESIC GRAMINOID ECOLOGICAL TYPE

Sample size = 15 plots

Photo - Plot 97792, Willow Creek, Horse Meadow

Landform and Setting

Lodgepole pine sites with graminoid understories. Depth to field capacity moisture averages 51 cm and depth to saturation averages 99cm. Temperature at 50cm averages 9 °C. Depth to soil moisture is greater and soil temperature is cooler than on sites with willow or rose understories. Elevation ranges from 6500 to 8200 feet. The most common soils in this type are Haplocryolls. A third of the soils sampled lacked the organic matter accumulation to be classed as Mollisols. They are mostly cold Entisols. Soil surface material is medium sand to silt textured. The average grain sizes are D_{50} = 424 and D_{10} = 58 microns. This type is most common on stream terraces (40%) and floodplains (33%) . Valley slopes average 4% and lateral slopes average 2%. This type was sampled in the Carson, Walker and Truckee river watersheds.

Description of Ecological Type Dynamics

Potential Natural Community (PNC) - Plant communities indicating high similarity to PNC are dominated by less than 30% cover of lodgepole pine and moderate to dense cover of gaminoid species. Typically, *Carex nebrascensis, Carex heteroneura* or a mixture of *Carex spp.* and *Juncus spp.* dominate the herbaceous layer. On drier sites *Carex rossii* may be quite common. These sites have a high potential for providing stable streambanks and controlling surface erosion if the cover of lodgepole pine remains below 30% and a dense herbaceous layer of graminoid species is maintained. Managing for high ecological status on these sites increases vegetation roughness and allows for capture of fine sediments and energy dissipation of flood flows. Infiltration rates and saturated hydraulic conductivity are both positively related to graminoid cover and negatively related to lodgepole pine cover over 30%. Water can enter and flow through the soil at a 10 times higher rate on sites with less than 20% pine and greater than 30%

graminoid cover as opposed to sites with more than 50% pine and less than 10% graminoid cover.

Disturbance Pathways - Cover of lodgepole pine is probably influenced by seasonal flooding and soil moisture. During wet years, these sites may be saturated for long perionds retarding encroachment of lodgepole pine. Conversely, during dry years, lodgepole pine may encroach on these sites. Once established, these lodgepole riparian communites appear to be long-lived. As tree size increases however, the trees act as water pumps, removing subsurface water through transpiration. This may eventually create dry sites occupied by marginal riparian species. Because surface soils are moist to wet for most of the growing season, these sites are susceptible to compaction from trampling by livestock and recreationists. Trails may drain moisture from sites near stream margins and allow for the establishment of pioneer disturbance species such as: *Achillea millefolium, Trifolium longipes, Geum macrophyllum*, and *Erigeron peregrinus*. Early spring grazing should be minimized or avoided to maintain soil stability and sedge cover.

Cross References to Other Classifications

PICO/CASC c.t. (Manning and Padgett, 1995) The drier sites in this community may be examples of this ecological type.

CONIFER/POPR c.t. (Manning and Padgett, 1995) This community represents low to moderate similarity to PNC.

Lodgepole Pine Series (Sawyer and Keeler-Wolf, 1995) Some of the sites in this series are within this ecological type. Compare landform, setting and plant composition to determine which represent this ecological type.

Characteristic Vegetation of the *Pinus contorta ssp. murrayana*/Mesic graminoid -- Haplocryoll -- Stream terrace and Floodplain ecological type

Plant Code	Scientific Name	Percent Constancy	Cover Range	Similarity to PNC
Grasses				
POPR	*Poa pratensis*	73	1-20	Moderate
PHAL2	*Phleum alpinum*	46	1-3	High
DEEL	*Deschampsia elongata*	40	1-5	Low
FERU2	*Festuca rubra*	33	1-10	Moderate
MURI	*Muhlenbergia richardsonis*	33	1	Moderate
STNE3	*Achnatherum nelsonii*	33	1-3	Moderate
DECE	*Deschampsia cespitosa*	26	1-5	High
BRCA5	*Bromus carinatus*	26	1	Moderate
Grasslikes				
LUSU7	*Luzula subcongesta*	33	1-3	High
CAPR8	*Carex preslii*	33	1-15	Low
CARO5	*Carex rossii*	33	1-3	High
JUBA	*Juncus balticus*	33	1-15	Moderate
CAHE8	*Carex heteroneura*	26	1-10	High
CANE2	*Carex nebrascensis*	26	3-17	High
JUOR	*Juncus orthophyllus*	26	1-11	Moderate
Forbs				
ACMI2	*Achillea millefolium*	93	1-5	Low
POGR9	*Potentilla gracilis*	60	1-4	Low
ERPE3	*Erigeron peregrinus*	60	1-15	Moderate
TAOF	*Taraxacum officinalis*	53	1-6	Low
TRLO	*Trifolium longipes*	53	1-16	Moderate
LULE2	*Lupinus lepidus*	46	1-3	Moderate
LIGR	*Ligusticum grayi*	40	1-3	Moderate
VECAC-2	*Veratrum californicum var. californicum*	33	1-12	Moderate
ANRO2	*Antennaria rosea*	33	1-8	Low
PODO4	*Polygonum douglasii*	33	1	Low
ASOC	*Aster occidentalis*	33	2-4	Low
GADI2	*Gayophytum diffusum*	33	1-3	Low
GEMA4	*Geum macrophyllum*	26	1-2	Moderate
EPCI	*Epilobium ciliatum*	26	1-3	Moderate
STLOL	*Stellaria longipes var. longipes*	26	1	High
Shrubs				
SALE	*Salix lemmonii*	26	3-37	High
SAGE2	*Salis geyeriana*	20	1	High
RIIN2	*Ribes inerme*	26	1-8	High
Trees				
PICOM	*Pinus contorta ssp. murrayana*	14	3-70	High*

* Cover above 30% is indicative of lower site function

***Pinus contorta ssp. murrayana*/Mesic graminoid -- Haplocryoll -- Stream terrace and Floodplain**

Location _____

Field Recorders _____

Date _____ Frame Size: 20 X 20 cm

Use Moist Non-Meadow Indicator Values for Any Additional Species

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total
Species Indicating High Similarity to PNC																					
PICOM4																					
PHAL2																					
LUSU7																					
CARO5																					
DECE																					
Species Indicating Moderate Similarity to PNC																					
POPR																					
ERPE3																					
TRLO																					
LULE2																					
LIGR																					
FERU2																					
Species Indicating Low Similarity to PNC																					
ACMI2																					
POGR9																					
TAOF																					
DEEL																					
MURI																					
JUBA																					

Environmental Features

Scorecard Values:

Rooting Depth (cm) _____ (many, fine or very fine roots)

Rooting Depth (cm) _____ (common, fine or very fine roots)

Dry soil color value of the A horizon _____ Infiltration rate (ml/5min) _____

Mapping Values:

Soil Taxa _____

Landform _____

Form # 17-2060-58 (9/98)

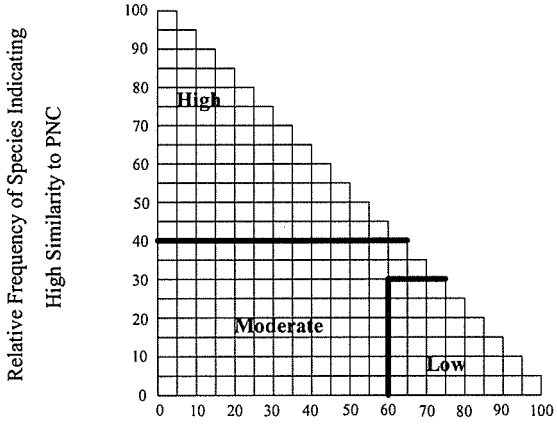
***Pinus contorta ssp. murrayana*/Mesic graminoid - Haplocryoll - Stream terrace and Floodplain**

Location: _____

Scorer: _____

Sample Date: _____

Vegetation similarity to PNC



Scorecard		
Ecological Status	Description	Notes
High Similarity to PNC	Vegetation has high similarity to PNC Rooting depth (many) 15 - 40 cm Rooting depth (common) 46 - 110 cm Soil A horizon dry color value 3 Infiltration rate (ml/5min.) 2458 - 4000	
Moderate Similarity to PNC	Vegetation has moderate similarity to PNC Rooting depth (many) 2 - 14 cm Rooting depth (common) 18 - 45 cm Soil A horizon dry color value 4 Infiltration rate (ml/5min.) 1448 - 2457	
Low Similarity to PNC	Vegetation has low similarity to PNC Rooting depth (many) 0 - 1 cm Rooting depth (common) 0 - 17 cm Soil A horizon dry color value 5 Infiltration rate (ml/5min.) 0 - 1447	

Pinus contorta ssp. murrayana/Salix spp. **-- Cryaquoll -- Floodplain ecological type**

LODGEPOLE PINE/WILLOW ECOLOGICAL TYPE

Sample size = 10 plots

Landform and Setting

Lodgepole pine sites with shrub or herbaceous understories. Depth to field capacity averages 13cm and depth to saturation averages 41cm during the growing season. Sites that key to this type are considered jurisdictional wetlands. Moisture is closer to the surface and temperatures warmer on this type than on the Lodgepole Pine/Mesic graminoid type. Soil temperature at 50cm averages 13 °C. Although the soil temperature mean is 4 degrees warmer, elevation range overlaps that of the Lodegpole Pine/Mesic graminoid type. Elevation for this type ranges from 6400 to 9100 feet. This type is primarily found on floodplains (90%), sometimes adjacent to stream terraces supporting the Lodgepole Pine/Mesic graminoid type. Average valley slope is 6% while aveargе lateral slope is 2%. Surface soil material is fine sand to silt. Average grain sizes are D_{50} = 189 microns and D_{10} = 56 microns. Redoximorphic features are common (60%). Surface horizon organic matter accumulation is sufficient for 60% of the soils to be classed as Mollisols. The most representative soil for this type is a Cryaquoll. This type was sampled in the Walker and Truckee river basins.

Description of Ecological Type Dynamics

Potential Natural Community (PNC) - Sites with high similarity to PNC have a good mix of overstory and understory species. The understory species such as *Carex lanuginosa, Carex nebrascensis, Salix spp., Symphoricarpos spp., and Ribes spp.* maintain soil tilth and infiltration/permiability. These sites have high potential for providing stable streambanks and controlling surface erosion if the cover of lodgepole pine remains below 30% and willow species are maintained in the shrub layer.

Disturbance Pathways - Loss of watertable and/or compaction can lead to site degradation. Species indicating a reduction in similarity to PNC are those more tolerant of sun and drying conditions. They include: *Agrostis stolonifera, Bromus anomalus,*

Aster occidentalis, Arnica chamissonis, Iris missouriensis, Potentilla gracilis and *Lotus purshianus.* Cover of lodgepole pine and willow on these sites is probably influenced by seasonal flooding and soil moisture. During wet years, these sites may be saturated for long periods, retarding lodgepole pine germination and establishment, but promoting willow establishment. During dry years, lodgepole pine seedlings will flourish but willow seedling establishment will be retarded. Because surface soils are moist to wet for most of the growing season, these sites are susceptible to compaction. Often, trails damage the sod layer, allowing for the establishment of pioneer species and draining the surface soil moisture.

Irregardless of ecological status, sites in this ecological type fit the criteria for jurisdictional wetlands. Efforts should be made to maintain and improve ecological function of these sites.

Cross References to Other Classifications

Lodgepole Pine Series (Sawyer and Keeler-Wolf, 1995) Many of the communities in this series represent this ecological type as well. Compare landform, setting and species composition to determine which are in this ecological type and what ecological status they represent.

Characteristic Vegetation of the *Pinus contorta* ssp. *murrayana*/*Salix* spp.-- Cryaquoll -- Floodplain ecological type

Plant Code	Scientific Name	Percent Constancy	Cover Range	Similarity to PNC
Grasses				
POPR	*Poa pratensis*	60	1-23	Moderate
CACA4	*Calamagrostis canadensis*	20	1	High
ELTRT	*Elymus trachycaulus ssp. trachycaulus*	20	1	High
FERU2	*Fetuca rubra*	10	1	Moderate
DECE	*Deschampsia cespitosa*	10	1	High
BRAN	*Bromus anomalous*	10	1	Moderate
CAPU	*Calamagrostis purpurescens*	10	6	High
Grasslikes				
CALA30	*Carex lanuginosa*	50	3-35	High
AGST2	*Agrostis stolonifera*	40	2-15	Low
JUBA	*Juncus balticus*	40	1-6	Moderate
SCMI2	*Scripus microcarpus*	30	1	Moderate
CANE2	*Carex nebrascensis*	30	1-10	High
CAUT	*Carex utriculata*	10	5	High
Forbs				
SMST	*Smilacina stellata*	50	1-12	High
ASOC	*Aster occidentalis*	40	1-7	Low
ARCHF	*Arnica chamissonis foliosa*	30	1-3	Low
EPCI	*Epilobium ciliatum*	30	1-3	Moderate
IRMI	*Iris missouriensis*	30	1	Low
SOSP3	*Solidago spectabilis*	20	1-4	Low
SPCA5	*Sphenosciadium capitellatum*	20	1	High
POGR9	*Potentilla gracilis*	10	1	Low
THSP	*Thalictrum sparsiflorum*	10	8	Moderate
SOCA6	*Solidago canadensis*	10	3	Low
RICEC2	*Ribes cereum*	10	6	Moderate
ACMI2	*Achillea millefolium*	10	3	Low
Shrubs				
ROWOU	*Rosa woodsii var. ultramontana*	60	1-23	Moderate
SALU2	*Salix lutea*	40	1-28	High
SAGE2	*Salix geyeriana*	30	40-84	High
SALUL	*Salix lucida ssp. lasiandra*	30	1-32	High
SALE	*Salix lemmonii*	20	1-6	High
RIIN2	*Ribes inerme*	20	7-9	High
Trees				
PICOM	*Pinus contorta ssp. murrayana*	90	1-76	High

Pinus contorta ssp. murrayana/Salix spp. **--Cryaquoll -- Floodplain**

Location _____

Field Recorders _____

Date _____ Frame Size: 20 X 50 cm

Use Moist Non-Meadow Indicator Values for Any Additional Species

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total
Species Indicating High Similarity to PNC																					
PICOM4																					
CALA30																					
SMST																					
SALU2																					
SAGE2																					
Species Indicating Moderate Similarity to PNC																					
ROWOU																					
POPR																					
JUBA																					
SCMI2																					
EPCI																					
FERU2																					
THSP																					
Species Indicating Low Similarity to PNC																					
AGST2																					
ASOC																					
ARCHF																					
IRMI																					
SOSP3																					
POGR9																					

Environmental Features

Scorecard Values:

Soil granular structure depth (cm) _____

Rooting Depth (cm) _____ (common, fine or very fine roots)

Mapping Values:

Soil Taxa _____

Landform _____

Form # 17-2060-60 (9/98)

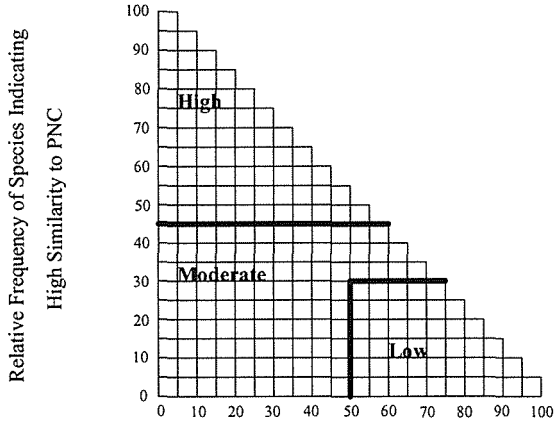
Pinus contorta ssp. murrayana/Salix spp. - Cryaquoll - Floodplain

Location: _____

Scorer: _____

Sample Date: _____

Vegetation similarity to PNC



Scorecard		
Ecological Status	Description	Notes
High Similarity to PNC	Vegetation has high similarity to PNC Rooting depth (common) 23 - 32 cm Soil granular structure depth 36 - 70 cm	
Moderate Similarity to PNC	Vegetation has moderate similarity to PNC Rooting depth (common) 18 - 22 cm Soil granular structure depth 14 - 35 cm	
Low Similarity to PNC	Vegetation has low similarity to PNC Rooting depth (common) 0 - 17 cm Soil granular structure depth 0 - 13 cm	

Form #17-2060-60 (9/98)

APPENDIX A. References

American Society of Agronomy and American Society for Testing and Materials (ASTM). 1965. Methods of soil analysis part 1; Agronomy Monograph 9. p. 202-207.

Argus, G. 1993. (personal communication). Canadian Museum of Nature, Ottawa, Ontario, Canada.

Brunsfield, S.J. and F.D. Johnson. 1985. Field Guide to willows of east-central Idaho. Bulletin number 39. Idaho Forest, Wildlife and Range Experiment Station, Moscow, Idaho; 83p.

Busby, F.E., J.C. Buckhouse, D.C. Clanton, G.C. Coggins, G.R. Evans, K.L. Gadzia, C.M. Jarecki, L.A. Joyce, D. Loper, D.L. Merkel, G.B. Ruyle, J.W. Thomas, J.H. Wald and S.E. Williams. 1994. Rangeland health: New methods to classify, inventory and monitor rangelands. National Research Council. National Academy Press, Washington D.C.; 180p.

Crampton, B. 1974. Grasses in California. University of California Press, Berkeley, California; 178p.

Cronquist, A., A.H. Holmgren, H.H. Holmgren, and J.L. Reveal. 1977a. Intermountain flora: Vascular plants of the Intermountain West, U.S.A. Vol. 1. Hafner Publishing Co., Inc. New York, New York; 270p.

Cronquist, A., A.H. Holmgren, H.H. Holmgren, J.L. Reveal and P.K. Holmgren. 1977b. Intermountain flora: Vascular plants of the Intermountain West, U.S.A. Vol. 6. Columbia University Press, New York, New York; 584p.

Cronquist, A., A.H. Holmgren, H.H. Holmgren, J.L. Reveal and P.K. Holmgren. 1984. Intermountain flora: Vascular plants of the Intermountain West, U.S.A. Vol. 4. New York Botanical Garden, Bronx, New York; 573p.

Cronquist, A., A.H. Holmgren, H.H. Holmgren, J.L. Reveal, P.K. Holmgren and R.C. Barneby. 1989. Intermountain flora: Vascular plants of the Intermountain West, U.S.A. Vol. Vol. 3, Part B. New York Botanical Garden, Bronx, New York; 279p.

Cronquist, A., A.H. Holmgren, H.H. Holmgren, J.L. Reveal and P.K. Holmgren. 1994. Intermountain flora: Vascular plants of the Intermountain West, U.S.A. Vol. 5. New York Botanical Garden, Bronx, New York; 496p.

Dingman, S.L. 1984. Fluvial hydrology. W.H. Freeman and Co., New York, New York; 383p.

Doran, J.W. and T.B. Parkin. 1994. Defining and assessing soil quality. In: J.W. Doran, D.C. Coleman, D.F. Bezdieck, and B.A. Stewart eds. Defining soil quality for a sustainable environment, SSSA Special publication 35. Soil Science Society of America Inc., Madison, Wisconsin.

Federal Interagency Committee for Wetland Delineation. 1989. Federal Manual for Identifying and Delineating Jurisdictional Wetlands. U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, and U.S. Department of Agriculture, Soil Conservation Service, Wahington, D.C. Cooperative technical publication; 76p + appendices.

Freeze, A.L. and J.A. Cherry. 1979. Groundwater. Prentice-Hall Inc.; 588p.

Gaugh, H.G. 1982, Multivariate analysis in community ecology. Cambridge Press, New York, New York; 299p.

Gifford, G.F. 1990. (personal communication). Department of Environmental Resource Sciences, University of Nevada, Reno, Nevada.

Hansen, P.L., S.W. Chadde and R.D. Pfister. 1988. Riparian dominance types of Montana. Misc. Pub. No. 49. Montana Riparian Association. Missoula, Montana; 358p.

Hickman, J.C. editor. 1993. The Jepson Manual, Higher Plants of California. The University of California Press. 1400p.

Hicks, T. 1998. unpublished data toward a classification of riparian areas on the Inyo National Forest. U.S. Department of Agriculture, Forest Service, Inyo National Forest, Bishop, CA.

Hill, M.O. 1979. TWINSPAN: A FORTRAN program for arranging multivariate data in an ordered two-way table by classification of the individuals and attributes. Cornell Univ. Ithaca, N.Y.

Hillel, D.J. 1980. Applications of soil physics. Academic Press, New York, New York; 385p.

Hudak, H., C. Elzinga. 1994 draft Riparian plant handbook. submitted to University of Nevada Press, Reno, Nevada (in review process).

Hurd, E.G., S. Goodrich, and N. Shaw. 1994. Field guide to Intermountain Rushes. GTR INT-306. U.S. Department of Agriculture, Forest Service, Intermountain Research Station, Ogden, Utah; 56p.

Jongman, R.H.G., C.J.F. ter Braak and O.F.R. van Tongeren. 1987. Data analysis in community and landscape ecology. Pudoc Wageningen. Netherlands; 274p.

Kattleman, 1996. In Sierra Nevada Ecosystem Project, Final Report to Congress, vol. II, Assessments and Scientific Basis for Management Options. Davis:University of California, Centers for Water and Wildland Resources; p. 855-920.

Kovalchick, B.L. 1987. Riparian zone associations, Deshutes, Ochoco, Fremont, and Winema National Forests. Tech. Paper R6 ECOL TP-279-87. U.S. Department of Agriculture, Forest Service, Pacific Northwest Region, Oregon; 171p.

Kovalchick, B.L., W.E. Hopkins and S.J. Brunsfield. 1988. Major indicator shrubs and herbs in riparian zones on National Forests of central Oregon. R6-ECOL-TP-005-88. U.S. Department of Agriculture, Pacific Northwest Region, Portland, Oregon; loose leaf, not paginated.

Lanner, R.M. 1983. Trees of the Great Basin, a natural history. University of Nevada Press, Reno, Nevada; 215p.

Leopold, Luna B., M.G. Wolman and J.P. Miller. 1964. Fluvial processes in geomorphology. W.H. Freeman and Company, San Francisco, California; 522p.

Ludwig, J.A. and J.F. Reynolds. 1988. Statistical Ecology. John Wiley and Sons, New York, New York; 337p.

Mackin, J.H. 1937. Erosional history of the Big Horn basin, Wyoming. Geological Society of America Bulletin. 48:813-894.

Manning, M.E., S.R. Swanson, T. Svejcar, J. Trent. 1989. Rooting characteristics of four intermountain meadow community types. J. Range Management 42(4):309-312.

Manning, M.E., and W.G. Padgett. 1992 draft. Riparian community type classification for the Humboldt and Toiyabe National Forests, Nevada and eastern California. U.S. Department of Agriculture, Forest Service, Intermountain Region, Ogden, Utah.

Manning, M.E., and W.G. Padgett. 1995. Riparian community type classification for the Humboldt and Toiyabe National Forests, Nevada and eastern California. R4-ECOL-95-01. U.S. Department of Agriculture, Forest Service, Intermountain Region, Ogden, Utah; 306 pages.

Mosely, J.C., S.C. Bunting and M. Hironaka. 1991. Determining range condition from frequency data in mountain meadows of central Idaho. Journal of Range Management 39(6):561-565.

Munsell Color Co. Inc., 1992. Munsell Color Chart. Macbeth Division of Lollmorgen Inst. P.O. Box 230, Newburgh, New York 12551-0230. 1992 revised ed.

Nachlinger, Janet Lynn. 1985. The ecology of sub-alpine meadows in the Lake Tahoe region, California and Nevada. A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Botany, University of Nevada Reno; 155 pages.

Padgett, W.G., A.P. Youngblood and A.H. Winward. 1989. Riparian community type classification of Utah and southeastern Idaho. Tech. Paper R4-ECOL-89-01. U. S. Department of Agriculture, Forest Service, Intermountain Region, Ogden, Utah; 191p.

Palmer, M.W. 1993. Putting things in even better order: the advantages of canonical correspondence analysis. Ecology. 74(8):2215-2230.

Ratliff, R. D. 1982. A Meadow Site Classification for the Sierra Nevada, California. GTR-PSW-60. U.S. Department of Agriculture, Forest Service, Pacific Southwest Forest and Range Experiment Station, Berkeley, CA 94701; 16 pages.

Ratliff, R. D. and S.E. Westfall. 1988. Biomass trends in a Nebraska sedge meadow, Sierra National Forest, California. Aquatic Botany 30:109-124.

Sawyer, J.O. and T. Keeler-Wolf. 1995. A Manual of California Vegetation. California Native Plant Society; 471p.

Schumm, S.A. 1991. To interpret the earth - Ten ways to be wrong. Cambridge University Press. New York, New York; 133p.

Sjoberg, K. and K. Danell. 1983. Effects of permanent flooding on *Carex-Equisetum* wetlands in northern Sweden. Aquatic Botany 15:275-286.

Smith, Sydney. 1998 draft. Riparian Community Type Classification for National Forests in Northeastern California: A First Approximation. Draft Copy dated May 1998. U.S. Department of Agriculture, Forest Service, Modoc National Forest, Alturas, California; 515 pages.

Society for Range Management, 1986. Range research: Basic problems and techniques. Society for Range Management. Denver, Colorado; 317p.

Society for Range Management, Task Group on Unity in Concepts and Terminology. 1995. New concepts for assessment of rangeland condition. Journal of Range Management 48(3):271-282.

Soil Survey Division Staff. 1993. Soil Survey Manual. U.S. Department of Agriculture Handbook No. 18. U.S. Department of Agriculture, Washington D.C.; 437p.

Soil Survey Division Staff. 1998. Keys to Soil Taxonomy, 8th Edition. U.S. Department of Agriculture, Natural Resources Conservation Service, Washington D.C.; 316p.

Tausch, R.J., D.A. Charlet, D.A. Weixelman and D.C. Zamudio. 1995. Patterns of ordination and classification sensitivity to changes in input data order. Vegetatio 6:897-902

ter Braak, C.J.F. 1987. CANOCO-A FORTRAN program for canonical community analysis by (partial) (detrended) (canonical) correspondence analysis, principle component analysis, and redundancy analysis (version 2.1). Agr. Math. Group, Wageningen, Netherlands.

U.S. Department of Agriculture, Forest Service. 1937. Range plant handbook. Dover Press reprint. New York, New York; 816p.

U.S. Department of Agriculture, Forest Service. 1975(8?) Stream reach inventory and channel stability evaluation - A watershed management proceedure. U.S. Department of Agriculture, Forest Service, Northern Region, Missoula, Montana; 25p.

U.S. Department of Agriculture, Forest Service. 1991. 2090.11 Ecosystem classification handbook. Washington, D.C.

U.S. Department of Agriculture, Forest Service. 1992. R4 Integrated Riparian Evaluation Guide. U.S. Department of Agriculture, Forest Service, Intermountain Region, Ogden, Utah; 53p + appendices.

U.S. Department of Agriculture, Forest Service. 1994. Ecological Subregions of the United States: Section Descriptions. U.S. Department of Agriculture, Forest Service, Ecosystem Management, Washington D.C. pages 33-5 and 47-4.

U.S. Department of Agriculture, Forest Service. 1997. Ecological Subregions of the United States: Section and Subsection Descriptions. R5-EM-TP-005 U.S. Department of Agriculture, Forest Service, Pacific Southwest Region, San Francisco, CA Chapter 9 and Chapter 17.

U.S. Department of Agriculture, Soil Conservation Service (now renamed the Natural Resources Conservation Service). 1975. Soil taxonomy-a basic system of soil classification for making and interpreting soil surveys. Ag. Handbook No. 436. U.S. Department of Agriculture, Soil Conservation Service, Washington D.C.; 754p.

U.S. Department of Agriculture, Soil Conservation Service (now renamed the Natural Resources Conservation Service). 1981. Land Resource Regions and Major Land Resource Areas of the United States, Agriculture Handbook 296. pages 16-17 and 19.

U.S. Department of Agriculture, Soil Conservation Service (now renamed the Natural Resources Conservation Service). undated pamphlet. Guide for estimating soil moisture by feel and appearance.

U.S. Department of Agriculture, Natural Resources Conservation Service. 1997. National Range and Pasture Handbook. U.S. Department of Agriculture, Natural Resources Conservation Service, Washington D.C.

U.S. Department of Agriculture, Natural Resources Conservation Service. 1998a. Field Indicators of Hydric Soils in the United States, Version 4.01.

U.S. Department of Agriculture, Natural Resources Conservation Service. 1998b. Keys to Soil Taxonomy.

Weaver, J.E. 1919. The ecological relations of roots. Carnegie Institute Publication 286. Washington D.C.

Weixelman, D.A., D.C. Zamudio, and K.A. Zamudio. 1996. Central Nevada Riparian Field Guide. R4-ECOL-96-01. U.S. Department of Agriculture, Forest Service, Intermountain Region, Toiyabe National Forest, Sparks, NV 89431.

Weixelman, D.A., D.C. Zamudio, K.A. Zamudio and R.J. Tausch. 1997. Classifying ecological types and evaluating site degradation. Journal of Range Management 50:315-321.

Youngblood, A.P., W.G. Padgett and A.H. Winward. 1985. Riparian community type classification of eastern Idaho-western Wyoming. R4-ECOL-85-01. U.S. Department of Agriculture, Forest Service, Intermountain Region, Ogden, Utah; 78p.

APPENDIX B. Index

Achillea millefolia **F-38**

Achnatherum nelsonii ssp. dorei F-1, **F-2**

Aconitum columbianum 4-67

Aira cespitosa see *Deschampsia cespitosa*

air dry 3-8

Agropyron trachycaulum see *Elymus trachycaulus* ssp. *trachycaulus*

Agrostis spp.

alba see *A. stolonifera*

exarata

scabra 4-51

stolonifera F-3, **F-4**

thurberiana

Allium bisceptrum var. *bisceptrum*

Alnus spp. 4-71, 4-77

Alopecurus aequalis 4-51

Alsine longipes see *Stellaria longipes var longipes*

Antennaria rosea **F-39**

aquic 3-8

Aquilegia formosa 3-7, 4-67, 4-77

Arnica

chamissonis Less. ssp. *foliosa* F-40, **F-41**

foliosa see *Arnica chamissonis* ssp. *foliosa*

mollis

Artemisia spp.

cana Pursh ssp. *bolanderi* 1-1, 3-4, **F-70**

cana ssp. *viscidula* F-70

tridentata ssp. *bolanderi* see *A. cana* ssp. bolanderi

tridentata ssp. *tridentata*

aspen **F-77**

Aster spp.

alpiginus 4-45

occidentalis **F-42**

spathulatus see *Aster occidentalis*

western **F-42**

avens

large-leaved **F-51**

baltic rush **F-32**

barley

meadow **F-10**

basal vegetation 3-30

bedstraw **F-49**

bentgrass

creeping F-3, **F-4**

bistort

mountain **F-57**

blue-eyed Mary **F-44**

bluegrass

Nevada F-18, **F-19**

Kentucky F-16, **F-17**

Skyline **F-15**

Bromus spp.

anomalus 4-88

tectorum 4-51

brooklime **F-68**

buttercup

water plantain **F-61**

Cardamine brewerii 4-27

Carex spp.

athrostachya **F-20**

atrata var. *erecta* see *C. heteroneura*

douglasii F-21, **F-22**

festivellia see *C. microptera*

filifolia 4-8

gymnoclada see *C. scopulorum* var. *bracteosa*

heteroneura **F-23**

lanuginosa 4-32, 4-50, 4-56, 4-62, 4-71, 4-88

microptera **F-24**

nebrascensis F-25, **F-26**

praegracilis 4-15

nervina 4-71

rossii 4-82

rostrata see *C. utriculata*

scopulorum Holm var. *bracteosa* **F-27**

simulata **F-28**

subnigricans 4-44

utriculata F-29, **F-30**

vesicaria 4-26

checker

Oregon **F-62**

cinquefoil

Northwest **F-60**

Cirsium spp.

drummondii see C. scariosum

foliosum see C. scariosum

scariosum **F-43**

tioganum see C. scariosum

cleavers **F-49**

clover

cows F-67

longstalk F-65

mountain carpet F-66

Collinsia parviflora **F-44**

color value of A horizon 3-30

Columbia needlegrass **F-1**

conservation threshold 2-2

Cornus sericea 4-77

Creeping bentgrass F-3, **F-4**

Cryaquoll 3-10

cumulic 3-10

D_{10} 3-9

D_{50} 3-9

dandelion

common **F- 64**

Deschampsia spp.

cespitosa F-5, **F-6**

elongata

Descurania californicum

Dodecatheon alpinum

drainageway 1-3

Dugaldia hoopesii F-45, **F-46**

ecological status 2-1, 3-30

ecological type 1-1, 2-1, 3-1

Eleocharis pauciflora **F-31**

Elymus spp.

elymoides

glaucus 4-71

triticoides see *Leymus triticoides*

trachycaulus ssp. trachycaulus F-7, **F-8**

Entisols 1-4

Epilobium ciliatum **F-47**

Equisetum arvense **F-48**

Erigeron peregrinus 4-83

fault-ling spring 1-3

Fescue

red **F-9**

Festuca rubra **F-9**

fibric 3-10

field capacity 3-8

fire 4-2, 4-71, 4-77

floodplain 1-3

fluvial landforms 1-1

foxtail **F-10**

frequency 3-23

Galium spp. F-49

divaricatum F-49

trifidum F-49

triflorum **F-49**

Gayophytum spp.

diffusum

ramosissimum **F-50**

Geum macrophyllum **F-51**

Glyceria elata 4-71

granular structure 3-30

gravel bar 1-1

Hackelia floribunda

hairgrass,

tufted F-5, **F-6**

Haplocryoll 3-10

Helenium hoopesii see *Dugaldia hoopesii*

hemic 3-10

Heracleum lanatum

historic climax plant community 2-1

Hordeum spp.

B-6

brachyantherum **F-10**

jubatum 4-51

nodosum see *H. brachyantherum*

horsetail

common **F-48**

hydric soils 4-20, 4-26, 4-31

Inceptisols 1-4

infiltration 3-26

Iris missouriensis **F-52**

Rocky Mountain **F-52**

Juncus spp.

balticus F-32, **F-33**

covillei (Piper) *var. obtusatus* **F-34**

nevadensis F-35, **F-36**

orthophyllus **F-37**

jurisdictional wetlands 1-3, 1-4, 3-8, 4-20, 4-26, 4-31, 4-44, 4-50, 4-56, 4-62, 4-67, 4-88

knotweed

Douglas' **F-58**

Kellogg's **F-59**

lateral slope 3-8

lettuce

miner's **F-54**

Leontodon officinale see *Taraxacum officinale*

Leymus spp.

cinerius

triticoides **F-11**

Ligusticum grayi

litter 3-30

lodgepole pine **F-78**

Lotus purshianus 4-89

lupine

dwarf **F-53**

Sierra **F-53**

Lupinus lepidus **F-53**

Luzula subcongesta

Melica hartfordii

milfoil **F-38**

Mimulus primuloides 4-44

Mollisols 1-4

Montia chamissoi **F-54**

muck 3-10

mucky peat 3-10

Muhlenbergia spp.

filiformis **F-12**

richardsonis F-13, **F-14**

muhly

mat F-13, **F-14**

pull-up **F-12**

Navarretia breweri

Osmorhiza chilensis 4-77

oxyaquic 3-8

pachic 3-10

peat 3-10

Penstemon rydbergii Nelson var. *oreocharis* **F-55**

Perideridia

lemmoni **F-56**

parishii F-56

Phleum alpinum 4-63

pine

lodgepole **F-78**

Pinus contorta ssp. *murrayana* **F-78**

Poa spp.

cusickii ssp. *epilis* **F-15**

epilis see *P. cusickii* ssp. *epilis*

nevadensis see *P. secunda ssp. juncifolus*

pratensis ssp. *agassizensis* F-16

pratensis ssp. *pratensis* F-16, **F-17**

secunda ssp. *juncifolius* F-18, **F-19**

platy structure 3-30

Polygonum spp.

bistortoides **F-57**

douglasii **F-58**

polygaloides **F-59**

Populus tremuloides **F-77**

potential natural community 2-1

Potentilla spp.

gracilis var. *fastigiata* **F-60**

gracilis var. glabrata see *P. gr. var fastigiata*

gracilis var. mollis see *P. gr. var. fastigiata*

gracilis ssp. nuttallii see *P. gr. var. fastigiata*

pussytoes

rose **F-39**

quaking aspen **F-77**

Ranunculus alismifolius **F-61**

redoximorphic features 3-8

retrogression 2-2

Ribes spp. 3-7, 4-67, 4-77, 4-88

inerme

rock fragments 3-9

rooting depth 3-26

and abundance 3-24

Rosa woodsii 4-67, 4-77

rush

baltic F-32, **F-33**

Coville's **F-34**

Nevada F-35, **F-36**

Straightleaf **F-37**

sagebrush

silver F-70

Salix spp.

boothii **F-71**

commutata F-72

eastwoodiae **F-72**

exigua **F-73**

geyeriana **F-74**

lemmonii 3-6, **F-75**

lucida ssp. *lasiandra* 4-56

lutea 3-6, **F-76**

orestra 4-44, F-72

planifolia 4-44, F-72

Saxifraga oregana

sapric 3-10

saturation 3-8

secondary succession 2-2

sedge

beaked F-29, **F-30**

Douglas F-21, **F-22**

Nebraska F-25, **F-26**

mountain **F-27**

ovalhead , see smallwing sedge

shortbeak F-28

slenderbeak **F-20**

smallwing **F-24**

variable-nerved **F-23**

Senecio spp.

hydrophilus 4-27

triangularis

Sidalcea oregana **F-62**

Smilacina stellata 4-67

smokeweed

many-flowered **F-50**

sneezeweed

tall mountain F-45, **F-46**

snowberry spp. 4-71, 4-77, 4-88

Sphenosciadium capitellatum 4-44, 4-77

soil color 3-9

soil cover 3-30

soil material 3-9

soil moisture 3-8

regime 3-8

soil temperature 3-9

soil texture 3-9

spikerush

fewflower **F-31**

Spiranthes romanzoffiana 4-44

starwort

longstalk **F-63**

Stipa columbiana see *Achnatherum nelsonii* ssp. *dorei*

Stellaria longipes var. longipes **F-63**

succession 2-1

Symphoricarpos spp. 4-71, 4-77, 4-88

Taraxacum spp.

laevigatum F-64

officinale **F-64**

Thalictrum sparsiflorum

thistle

elk **F-43**

toad lily **F-54**

Trifolium spp.

longipes **F-65**

monanthum **F-66**

wormskjoldii **F-67**

Tufted hairgrass F-5, **F-6**

typic 3-10

valley slope 3-8

Veratrum californicum var. californicum 4-21

Veronica spp. **F-68**

americana F-68

Vicia americana

Viola spp.

nephrophylla see *V. sororia* ssp. *affinis*

sororia Willd. ssp. *affinis* **F-69**

violet

sand **F-69**

wheatgrass

slender F-7, **F-8**

white fir 4-77

wildrye

beardless **F-11**

creeping **F-11**

wildtansy **F-38**

willow spp.

Booth's **F-71**

cold 4-62, 4-67, F-71, F-74, F-75

Geyer's **F-74**

Lemmon's **F-75**

sandbar **F-73**

Sierra **F-72**

warm 4-62, F-73, F-74, F-76

yellow **F-76**

willowherb

fringed **F-47**

wiregrass **F-32**

yampah

Lemmon's **F-56**

Parish's F-56

yarrow

common **F-38**

APPENDIX C. Field Methods Used in Classifying Ecological Types and Developing Scorecards

Sample plots were located in representative riparian ecosystems of the Sierra Nevada Region. Sampling was started on the Bridgeport Ranger District in 1994 and extended onto the Carson Ranger District in 1995. Sampling was completed in 1997. Plot selection was based on stratified sampling as well as "location for condition evaluation" criteria (Schumm, 1991) used in geomorphic investigations. Plots with homogeneous vegetation were selected to represent the apparent range in site and successional conditions within an area. Following methods summarized by H.G. Gauch (1982), plots were sampled so as to provide replicate samples but not beyond that needed to describe each ecological type and ecological status class. Scarce samples such as PNC ecological status sites were intentionally sought out. Drainages were surveyed by aerial photo or vehicle to locate possible plots. We also relied on the work of Manning and Padgett (1995) to locate plots in certain community types. Plots were located on landform sequences associated with developmental age. Efforts were made to sample relict sites as well as the erosional and depositional landforms derived from them. Cover composition of species indicating low similarity to PNC was assessed to determine apparent ecological status in the field.

A total of 249 riparian plots were sampled over the four field seasons. Plot size was not limited, but was approximately 1/5th acre in size. The observer had to be able to see the entire plot; the plot had to be representative of the stand; and it could not include ecotones or a variety of landform surfaces. The adjacent stream reach also needed to be relatively homogeneous, with no major changes in grade for a least a meander length upstream or downstream of the plot.

At each plot a complete inventory of vascular plants was recorded. Plants not field identified were collected. Voucher specimens of some species were also collected for verification by specialists. Within each (macro)plot, 3, 20-meter transects were sampled for cover and frequency of each species. The transects were most often laid out parallel to each other but occasionally were laid in series for long narrow plots. The frequency frame size used depended on the vegetation structure being sampled. Tree types were sampled with a 1m square frame. Nested frame sizes were: 1m X 50cm, 50 X 50cm and 20 X 20cm. Shrub types were sampled with a 50cm square frame. Nested frame sizes were: 20cm X 50cm, 20cm X 20cm and 10cm X 10cm. Herbaceous types were sampled on a 20cm X 20 cm frame. Nested frame sizes were: 20cm X 10cm, 10cm X 10cm, 5cm X 5cm. The frames were placed at 1 meter intervals down the transect. Nested frequency was recorded for each species rooted in the frame. Ground cover values were recorded in two ways. Marked points on the frequency frame were used to sample 200 - 300 points per plot. This was most commonly done on woody sites. On herbaceous sites a drop-pin point cover frame was used to measure 200-300 points per plot. An ocular estimate of cover by species was made for each plot as a whole. There was no subsampling of plant species cover. For those plots with an aspen or lodgepole pine overstory, 40 systematically chosen trees were measured for overstory crown cover, height and diameter breast high.

Plant species were identified using the taxonomic nomenclature of The Jepson Manual of Higher Plants of California (Hickman, 1993).

A one meter deep soil profile was described at a representative spot in each plot, using standard field methods (Soil Survey Division Staff, 1993). Soils were classified to the family level using Keys to Soil Taxonomy, 8th Edition (Soil Survey Staff, 1998). Particular attention was paid to moisture conditions and indications of past moisture conditions for each horizon. Evidence of fluvial deposition of soil material was also carefully noted, such as imbricated gravel lenses. Samples of the surface soil horizon

were collected and sieved to evaluate grain curve. Soil temperatures at 20 and 50cm depths were recorded.

To characterize the setting of the plots, elevation, aspect, slope, landform, and valley gradient were recorded. Attempts were made to connect the sampled plots to stream hydrology. On streams adjacent to several plots we also recorded channel dimensions and morphology, water slope and bed material sizes. Controls on the stream gradient/energy which defined the sampled reach were recorded (Dingman, 1984). Channel and valley roughness values were assigned based on vegetation height and rockiness of the surface (Dingman, 1984). Region 1 methods were used to score the upper bank, lower bank, and channel bottom for stability (USDA Forest Service, 1975(8?). Greenline transects were sampled to record extent of each plant community along both banks of any live stream (USDA Forest Service, 1992). Five cross-sections were paced across the riparian area perpendicular to the channel for bankside plots. At each change in landform or plant community, distance and elevation change was recorded from a benchmark. Regeneration of woody species was also recorded on belts along each bank.

Infiltration rate was used as a measure of how fast a soil-plant community absorbs water. On all plots that were drier than field capacity, a set of three infiltration rings were used as outlined in Agronomy Monograph 9, Methods of Soil Analysis Part 1 (American Society of Agronomy and American Society for Testing and Materials, 1965). Infiltration tests were run for a half hour with five minute intervals between readings.

APPENDIX D. Office Methods Used in Classifying Ecological Types and Developing Scorecards

All field data were edited and entered into computer datatables using ORACLE, a relational database software package. Queries through ORACLE were used to check the data entered into the computer. Vegetation cover data from all riparian plots was run through TWINSPAN to establish an initial plant community classification. TWINSPAN is a polythetic divisive classification program in the Cornell Ecology Package of computer programs (Hill, 1979). Reordering the plots changed the TWINSPAN output to some degree, so five iterations of differing order were used to determine a plot's fidelity to a particular ecological group (Tausch, et.al., 1995).

Discriminant analysis was then used to compare soil-water and landform characteristics among the TWINSPAN groups to determine which groups have a similar potential to produce vegetation, i.e., ecological types. Starting with the initial TWINSPAN split, a discriminant test ($P<0.10$) was conducted and soil-water and landform variables were selected that optimally predicted the classification (Jongman, et.al., 1987). Successive splits were analyzed until an ecological type could not be further divided based on soil-water and landform characteristics. Fifteen ecological types were described. From the results of the discriminant tests, a dichotomous key was constructed for riparian ecological types.

Up to ten landform and soil-water variables were included in each discriminant test: landform, soil taxon (family level), valley slope, lateral slope, elevation, depth to saturation, depth to mottling, depth to gleying, depth to coarse fragments, soil temperature and the D_{10} grain size in the soil's A horizon. For a discriminant test to be unbiased, the number of independent soil-site variables must be less than the individual group sample size (Ludwig and Reynolds, 1988). Before analysis, the environmental variables were checked for normality and found to have Poisson distributions. The variables were normalized using a square root transformation. Each variable type was identified as either continuous, ordinal, or nominal and treated as such in the multivariate test (Ludwig and Reynolds, 1988). Selection of important variables, the decision of how to standardize data and selection of multivariate methods are subjective choices that can influence the resulting classification. Experience gained in reconnaissance, observation and field sampling guided these choices in an effort to provide an integrated classification, more closely related to the real world than any strictly algorithmic classification.

Ecological types were also delineated using Canonical Correspondence Analysis (CCA) (ter Braak, 1987). The soil-water and landform variables were transformed to zero mean and unit variance for CCA. CCA is a direct gradient analysis technique that relates sample sites directly to a set of soil-water and landform variables in ordination space (Palmer, 1993). Results of CCA were helpful in detecting the relationships between key soil-water variables and plant composition.

Sites within each ecological type were then separated into one of three ecological status classes using Canonical Correspondence Analysis (Weixelman, et.al., 1997). This allowed us to relate species data to a set of five biotic and abiotic indicators of ecological health. Selected biotic and abiotic indicators were: percent basal cover of vegetation, percent litter cover, rooting depth (cm), rate of infiltration (ml/sec), and compaction as indicated by the occurrence of platy soil structure. Biotic and abiotic indicators that explained a significant amount of variation in the CCA results ($p<0.10$) were considered significant indicators of ecological health within a type. Based on the results of CCA, plots were assigned to one of three ecological status classes. Discriminant analysis was used to determine variables that discriminated among the three ecological status classes. Based on the results of CCA analysis, plant species were associated with one of three ecological status classes. For example, if a plant species was shown to be associated with

plots that have high similarity to PNC, as shown by CCA analysis, then the plant species was assigned as an indicator of high similarity to PNC. Similarly, species indicative of moderate and low similarity to PNC were identified. Later, species indicator values were verified by a panel of Forest Service ecologists from California and southern Oregon. Consensus ratings of species by the ecologists were very similar to those we had developed analytically. Discriminant functions were computed (Mosely et al., 1991) for each ecological type that can be used to estimate ecological status based on the frequency of occurrence of species. These analyses provided a multivariate approach for developing scorecards that describes the values (plant and soil) to be expected in each of the three ecological status classes.

Scorecards are based on vegetation, landform, and edaphic characteristics that were found to repeat over the landscape, thus they can be used throughout the study area. The scorecards can be used in the field to estimate ecological status with a minimum of equipment and time.

Ecological Type

	ARCA/MG	Dry graminoid	POCU3	CASC12	CAUT	Mesic Graminoid CANE2	W. Willow/Gravel bar SAEA	W. Willow/Floodplain	Cold Willow/M.G.	POTR5/M.G.	POTR5/Tall Forb	PICOM4/M.G.	PICOM4/SALIX
No of Plots	18	16	10	18	11	36	25	11	9	10	28	10	9	15	10
Soil Taxa															
Mollisol	95%	81%	90%	50%	73%	78%	84%	64%	–	20%	54%	90%	78%	60%	60%
Inceptisol	–	–	–	33%	–	14%	8%	18%	–	10%	3%	–	–	7%	20%
Entisol	5%	13%	10%	17%	9%	8%	8%	18%	100%	70%	43%	10%	12%	33%	20%
Histosol	–	–	–	–	18%	–	–	–	–	–	–	–	–	–	–
Other	–	6%	–	–	–	–	–	–	–	–	–	–	–	–	–
Moisture Taxa															
Aqu	11%	6%	20%	44%	18%	56%	20%	55%	33%	40%	50%	10%	–	33%	50%
Aquic	17%	19%	60%	17%	9%	14%	16%	9%	–	20%	4%	10%	22%	20%	10%
Oxyaquic	17%	6%	–	33%	27%	28%	–	27%	44%	30%	43%	50%	11%	20%	40%
Average Depth to Saturation	–	–	85cm	43cm	18cm	34cm	–	35cm	51cm	48cm	38cm	–	–	99cm	41cm
Average Depth to Field Capacity Moisture												27cm	53cm	51cm	
Temperature Taxa															
Cryic	100%	75%	100%	100%	100%	94%	100%	100%	44%	70%	100%	100%	100%	93%	90%
Frigid		25%				6%									
Average Temperature 50cm	12C	14C	10C	9C	10C	11C	12C	9C	14C	12C	10C	9C	10C	9C	10C

APPENDIX F. Illustrated Riparian Indicator Plant Species

Achnatherum nelsonii ssp. dorei (Barkworth & J. Maze) Barkworth - Columbia needlegrass

Poaceae (aka. *Stipa columbiana* Macoun)

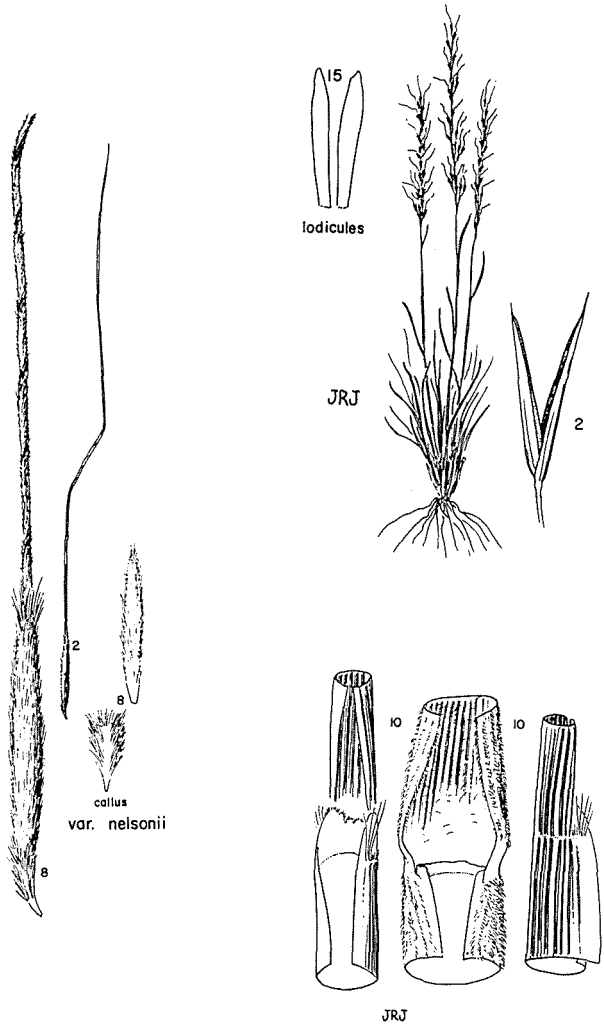
Stout, tufted perennial, 4-17.5dm. Culms strongly ribbed. Leaf blade 0.5-4.5mm wide, often rolled. Ligules short, 0.2-1mm long, truncate; usually longest on the sides, decurrent. Inflorescence 9-36cm long, narrow; the lowest branches separated from the rest of the panicle. Panicle branches relatively short with numerous spikelets. Spikelet one flowered 4.5-7mm, glumes 6-12.5mm, callus blunt, lemma $\pm$ 2 X palea length, hairs 1-2mm; awn 13-45mm, distal segment of awn straight.

Meadows, clearings, sagebrush shrubland steppe; 500-3500m (Hickman, 1993). This species was most frequently sampled on plots in the *Carex nebrascensis*, *Poa cusickii ssp. epilis*, Dry graminoid, *Artemisia cana*/Mesic graminoid and *Pinus contorta ssp. murrayana*/Mesic graminoid ecological types. High forage value especially late season, have fibrous roots, seed well and withstand grazing well. Seeds may be mechanically injurious to animals (USDA, 1937). Well adapted to droughty soils, widespread but not very dense stands. Green up early in the season. *Stipas* invade disturbed soils and because of their strong root system are valuable in erosion control (Crampton, 1974).

F-2

Achnatherum nelsonii ssp. dorei (Barkworth & J. Maze) Barkworth - Columbia needlegrass

Illustration by Jeanne R. Janish reprinted with permission from *Intermountain Flora Vascular Plants of the Intermountain West, U.S.A.* vol. 6, A. Cronquist et al., copyright 1977, The New York Botanical Garden.



Agrostis stolonifera L. - Creeping bentgrass

Poaceae (aka. *Agrostis alba* L. in part, Redtop)

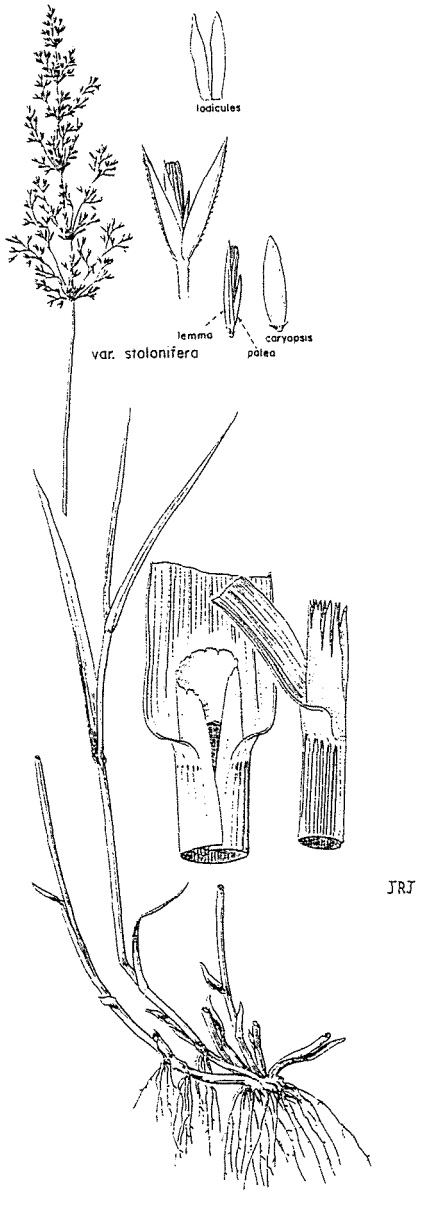
Decumbent to erect, often mat-like, stoloniferous perennial, 0.8-6dm. Leaves 2-10cm long, 2-5mm wide, flat. Ligules 1.5-5mm long, membranous, lacerate. Inflorescence open to somewhat narrow panicle 3-15cm. Spikelet 1 flowered, 1.5-2mm; glumes 1.5-3mm; lemma unawned.

Ditches, lake margins, marshes below 1000m (Hickman, 1993). Steambanks and meadows and moderately moist sagebrush slopes from low to middle elevations. This species was frequently encountered in *Carex nebrascensis*, Mesic graminoid, Dry graminoid, *Artemisia cana*/Mesic graminoid, Warm willow/Floodplain, Warm willow/Gravel bar and *Pinus contorta ssp. murrayana/Salix spp.* ecological types. Cultivated, introduced species (Cronquist et al., 1977b). At higher elevations it remains green through most of the season and recovers well from close grazing. Valuable in retaining soil on roadbanks and along ditches (Crampton, 1974). Valuable for reseeding. As resistant to cold as is timothy and better at withstanding summer heat. Able to grow in shallow ponds which later dry and in acidic soils. Grows best on rich, sandy or clay loams. Not tolerant of shade. The vigorous intertwining rootstocks of this grass form a dense sod which binds the soil firmly and enables the plants to withstand excessive trampling and close grazing. On meadows at mid to high elevations, 8-10 lbs/acre seeding with shallow soil treatment has been reported to establish a full stand. The plants grow vigorously, forming a good turf in a short time, making them valuable for reclaiming gullies and banks. (USDA, 1937). Water table depth is commonly 30-60cm, but it can also grow in drier sites where the water table depth is 1m or more during the growing season, especially on finer soils (Padgett et al., 1989). Preferred soil temperature regimes are mesic and frigid. Meadows containing both *A. stolonifera* and *Deschampsia cespitosa* may convert to nearly solid *A. stolonifera* under heavy livestock use due to preference for *D. cespitosa*. Shallow roots of the *A. stolonifera* sod do not form stable overhanging banks for fish habitat. (Hudak, et al., 1994 draft).

F-4

Agrostis stolonifera L. - Creeping bentgrass

Illustration by Jeanne R. Janish reprinted with permission from *Intermountain Flora Vascular Plants of the Intermountain West, U.S.A.* vol. 6, A. Cronquist et al., copyright 1977, The New York Botanical Garden.



Deschampsia cespitosa (L.) Beauv. - Tufted hairgrass

Poaceae (aka. *Aira cespitosa* L.)

Densely clumped perennial, 2-10dm. Leaves generally basal, 8-20cm long, flat to inrolled 1-4mm wide, glabrous to scabrous; ligules 3-8mm long, acute to obtuse, often toothed at tip. Inflorescence loose, often nodding panicle 5-20cm long; spikelets 2 flowered usually shiny, purplish, 2.4-4mm long, glumes 3-5mm long, 1-3 nerved. Lemma purplish at base, toothed at apex. Awn 2-5mm long, attached at lower half of lemma, straight to slightly bent.

Wet sites, meadows, streambanks, coastal marshes, forest, alpine below 3900m (Hickman, 1993). Streambanks, lakeshores and wet mountain meadows at subalpine and alpine elevations (Cronquist et al., 1977b). In the study area, we frequently found Tufted hairgrass in the *Carex utriculata*, *Carex nebrascensis*, *Carex scopulorum, Poa cusickii ssp. epilis, Salix eastwoodiae*, Cold willow/Mesic graminoid, *Pinus contorta ssp. murrayana*/Mesic graminoid, *Pinus contorta ssp. murrayana/Salix spp.*, and *Populus tremuloides*/Mesic graminoid ecological types. Tufted hairgrass is a principal component of mountain meadows, where it is one of the most important range species since all classes of livestock forage on the plant; it is widely distributed, frequently in dense stands, it can withstand rather close grazing and recovers well. It is also valuable in control of soil erosion (Crampton, 1974). In well-watered parks and meadows, it often grows in nearly pure stands which on more favorable sites form a nearly complete ground cover. On drier, less favorable sites, it commonly grows in rather open stands in mixture with sedges, *Trisetum, Sibbaldia procumbens* and other plants. It distinctly prefers the open and practically never is found in dense shade, although it is common in partial shade among willows and in open timber. New plants are established entirely from seed and sufficient seed should be permitted to mature to provide necessary replacements (USDA, 1937). It can occasionally be found as a colonizing species on recently deposited substrates along stream channels. Tufted hairgrass is most often found on fine textured soils, clay to sandy loams, usually containing a significant amount of rocks and cobbles. It is sometimes found on organic soils and occasionally on well drained coarse soils with a high water table. It can tolerate moderately acidic and moderately alkaline soils. Soil temperature regimes vary from mesic to cryic. Water tables are generally within 20-100cm of the surface, and soils are moist throughout the growing season (Padgett et al., 1989). Water tables may be seasonally at the surface or sometimes inundating during spring. It can tolerate periods of flooding up to 60 days. Successful reproduction is likely a rare event since seed is short-lived, germination is only fair and initial establishment may be poor (Hudak et al., 1994 draft).

F-6

Deschampsia cespitosa (L.) Beauv. - Tufted hairgrass

Illustration by Jeanne R. Janish reprinted with permission from *Intermountain Flora Vascular Plants of the Intermountain West, U.S.A.* vol. 6, A. Cronquist et al., copyright 1977, The New York Botanical Garden.

Elymus trachycaulus ssp. trachycaulus (Link) Shinn. - Slender wheatgrass

Poaceae (aka. *Agropyron trachycaulum* (Link) Malte)

Tufted perennial, sometimes with short rhizomes, 3-15dm. Leaf sheath glabrous to hairy, appendages short or lacking, blades stiffly ascending to somewhat lax, usually flat 2-7mm wide. Ligule less than 0.5mm long. Inflorescence a narrow spike, 4-20cm long, spikelets 1 per node. Spikelets 3-7 flowered, 9-20mm long, those at midlength of the rachis usually about twice as long as the internodes; glumes oblong-elliptical, 5-15mm long and 1-3mm wide, gradually or abruptly tapering to an acute or awn-tipped apex. Lemmas 6-13mm, glabrous to hairy, awns less than 7mm.

Dry to moist, open areas, forest, woodland below 3400m (Hickman, 1993). Dry to moist roadsides, ditchbanks, streambanks, meadows and woodlands (Cronquist et al., 1977b). Occurring in light, sandy soils in meadows, open grasslands, bottomlands, and on moist slopes. New plants are established entirely by seed (USDA, 1937). Dry to somewhat moist soils (Crampton, 1974). Found most commonly in Mesic graminoid, *Poa cusickii ssp. epilis, Artemisia cana*/Mesic graminoid, Warm willow/Floodplain, Warm willow/Gravelbar, and *Pinus contorta ssp. murrayana/Salix spp.* riparian ecological types of the eastern Sierra Nevada.

A valuable forage grass of summer rangelands where young growth, stems and seedheads are usually well grazed by domestic animals. The strong root system resists pulling up by grazing animals and may help in controlling erosion (Crampton, 1974).

F-8

Elymus trachycaulus ssp. trachycaulus (Link) Shinn. - Slender wheatgrass

Illustration by Jeanne R. Janish reprinted with permission from *Intermountain Flora Vascular Plants of the Intermountain West, U.S.A.* vol. 6, A. Cronquist et al., copyright 1977, The New York Botanical Garden.

Festuca rubra L. - Red fescue

Poaceae

Loosely tufted perennial, sometimes with short rhizomes, 3-8dm. Leaf sheath closed, more or less reddish, shredding with age, with downward pointing hairs; blade 5-30cm long, less than 3mm wide, folded or rolled; ligule less than 0.5mm. Inflorescence 5-20cm long, open with ascending branches. Spikelets 9-12mm long; lower glume 2.5-3.5mm; upper 3.5-5.5mm; lemma 5-7mm, sometimes scabrous near tip, awn less than 4mm, scabrous.

Sand dunes, grassland, subalpine forest generally below 2500m. (Hickman, 1993). Plants of variable habitats from moist meadow soils to drier sites. Best adapted to cooler summers and moisture throughout the growing season. (Crampton, 1974). Most frequently encountered on plots in *Carex utriculata*, *Carex nebrascensis,* Mesic graminoid, *Poa cusickii ssp. epilis*, Warm willow/Floodplain, Cold willow/Mesic graminoid, *Pinus contorta ssp. murrayana*/Mesic graminoid, and *Pinus contorta ssp. murrayana/Salix spp.* ecological types in the eastern Sierra.

Illustration by Jeanne R. Janish reprinted with permission from *Intermountain Flora Vascular Plants of the Intermountain West, U.S.A.* vol. 6, A. Cronquist et al., copyright 1977, The New York Botanical Garden.

F-10

Hordeum brachyantherum Nevski - Meadow barley

Poaceae (aka. *Hordeum nodosum,* foxtail)

Tufted perennial to 9dm tall. Leaves 1.5-9mm wide, glabrous or hairy, ligules short, 0.2-0.7mm, truncate, ciliolate, auricles lacking. Inflorescence a spike 2-5cm long, erect, green or brownish-purple in maturity, spikelets three at each node, the central fertile and the outer sterile. Lemma of the fertile floret 6.5-8mm long, tapering into a short awn 5-10mm long. Sterile florets reduced, their awns 7-20mm long.

Moist mountain meadows and along streambanks, less often among sagebrush vegetation or on rocky slopes (Cronquist et.al, 1977b). Meadows, pastures, streambanks (Hickman, 1993). Chiefly in moist soils along streams and in poorly drained meadows and parks, from plains and foothills upward to aspen and spruce belts, typically attaining best development on sunny, open exposures. It is very common in partial shade as among shrubs and in open aspen stands (USDA, 1937). In the eastern Sierra region we sampled meadow barley in wet and moist meadow ecological types as well as in Warm willow/Gravel bar, *Salix eastwoodiae*, and Cold willow/Mesic graminoid ecological types. Good forage only prior to curing. Tends to increase and replace more palatable plants in moist meadows if sites are overgrazed (USDA, 1937).

Illustration by Jeanne R. Janish reprinted with permission from *Intermountain Flora Vascular Plants of the Intermountain West, U.S.A.* vol. 6, A. Cronquist et al., copyright 1977, The New York Botanical Garden.

Leymus triticoides (Buckley) Pilger - Beardless wildrye

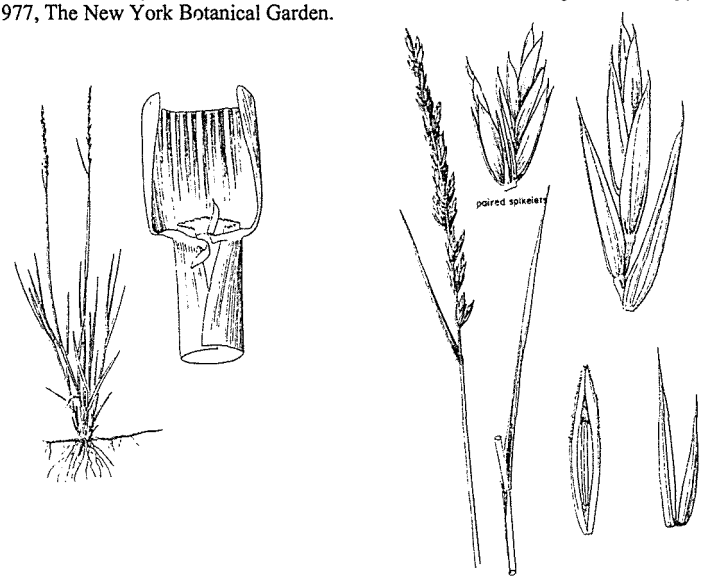
Poaceae (aka. *Elymus triticoides* Buckley, Creeping wildrye)

Perennial from rhizomes, 4.5-13dm. Leaves 2.5-4mm wide, upper surface finely scabrous, ligule 0.2-1.3mm truncate, erose-ciliolate, the auricles well developed often clasping the culm. Inflorescence a short spike 3.5-7cm long, spikelets paired or sometimes solitary at each node, 10-16mm long, 3-5 flowered, lemmas 6-9mm long often shiny and smooth, glabrous or puberulent sometimes only at the apex. Glumes 7-10mm long, narrow to subulate, firm 1-3 nerved, scabrous. Lemma short awned 0.5-2.5mm or awnless.

Moist, often saline meadows, below 2300m (Hickman, 1993). Dry to moist places in valley bottoms, often in saline meadows (Cronquist et al., 1977b). Mostly on heavy soils with adequate soil moisture during the growing season (Crampton, 1974). Most often found on clay swales in dry lake basins or on sandy loam soils around the edge of basins, but tolerant of a wide range of soils including alkaline soils. Growth is best on moist clay soils. Preferred soil temperatures are mesic and frigid (Hudak et al., 1994 draft). In the eastern Sierra study area it was frequently found in *Carex utriculata*, Dry graminoid, *Artemisia cana*/Mesic graminoid and Warm willow/Gravel bar ecological types.

Beardless wildrye often fails to set seed. Perhaps this is due to the need for the species to be cross pollinated. Large stands may represent a single clone (Cronquist et al., 1977b). Good forage grass, resistant to trampling and capable of good recovery after close grazing. Valuable as a soil binder, particularly along levees and river banks (Crampton, 1974). The species has been cut for hay along the Humboldt River and the seed was used as a food staple by native Americans of the Great Basin. (USDA, 1937). This species can withstand moderate levels of grazing; it persists well and will initially increase with disturbance. Commercial seed planted in the fall and transplantation of rhizomes are means of propagation (Hudak et al., 1994 draft).

Illustration by Jeanne R. Janish reprinted with permission from *Intermountain Flora Vascular Plants of the Intermountain West, U.S.A.* vol. 6, A. Cronquist et al., copyright 1977, The New York Botanical Garden.



F-12

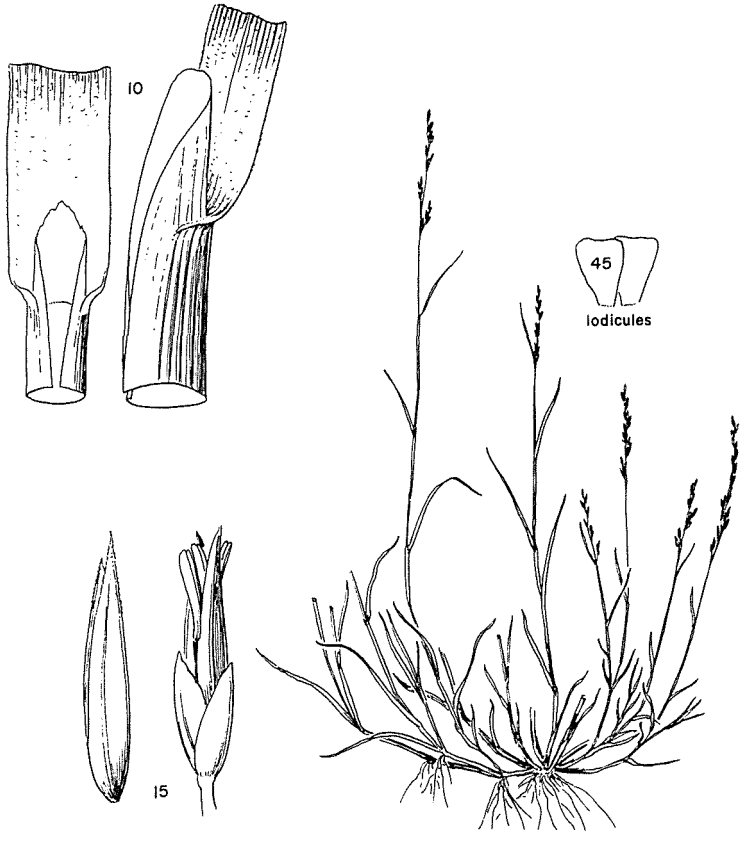
Muhlenbergia filiformis (Thurber) Rydb. - Pull-up muhly

Poaceae

Loosely clumped, annual grass often with short stolons. The stems are decumbent and root at the nodes, 0.2-3dm. Leaves are 1-4cm long, 1-2mm wide, flat or rolled. Ligules are 1-2.5mm, obtuse to acute with serrate margins. The inflorescence is narrow and cylindric, 1-6cm long and less than 1 cm wide; spikelets are 1 flowered generally; glumes are 0.5-1.2mm, obtuse and minutely toothed; lemma is abruptly pointed, 1.5-2mm long.

Native, found in moist meadows, seeps and on streambanks to 3350m (Hickman, 1993). Occasionally in open woods in moist spots (Crampton, 1974). Wet places in mountain meadows, sometimes forming dense stands at edges of pools and seeps (sometimes around thermal springs). In the Sierra we sampled *Muhlenbergia filiformis* most frequently in wet meadow ecological types as well as in Mesic graminoid, *Poa cusickii ssp. epilis, Salix eastwoodiae* and Cold willow/Mesic graminoid ecological types.

Illustration by Jeanne R. Janish reprinted with permission from *Intermountain Flora Vascular Plants of the Intermountain West, U.S.A.* vol. 6, A. Cronquist et al., copyright 1977, The New York Botanical Garden.



Muhlenbergia richardsonis (Trin.) Rydb. - Mat muhly

Poaceae

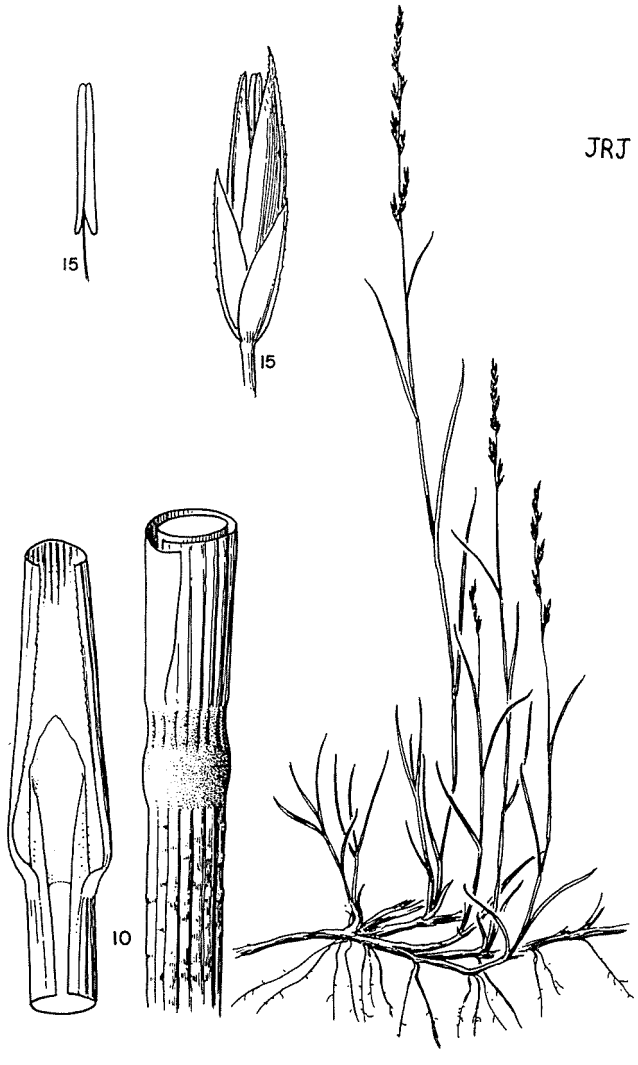
Matted, rhizomatous, perennial, 0.5-4dm. The lower nodes of the stem are often swollen or knot-like. Stems are often much branched at the base. Leaves are 1-5cm long, 1-2mm wide, flat to rolled. Ligules are 1-2.5mm long, acute to truncate. The inflorescence is a narrow, spikelike panicle 1-4cm long, with short branches; spikelets are 1 flowered, green to black; lemma 2-2.5mm long, nearly twice as long as the glumes. The lemma is short awn tipped, up to 0.3mm long.

Open sites, more or less moist meadows, talus slopes, along streams 1220-3670m (Hickman, 1993). Moist to moderately moist situations in meadows, along streams and margins of ponds, lakes, often in alkaline soils, mostly in the mountains, sometimes up to timberline. Sometimes forming dense mats in moist mountain situations where it is a good soil binder and forage grass (Cronquist et al., 1977b). Growing in dry meadows, parks and open flats in ponderosa pine, lodgepole pine, and spruce-fir belts, occasionally extending down into sagebrush flats on sandy, gravelly or clay loam soils. Occurs to some extent on alkaline soils (USDA, 1937). Dry to moist mountain slopes, flats or valleys, edges of meadows, mostly in open areas above 5000ft in elevation (Crampton, 1974). In riparian sites, mat muhly is most commonly found in alkaline meadows. Soils supporting mat muhly are moist all year, or moist in spring and drying in fall. Preferred soil temperature regime is frigid. Mat muhly usually grows in open areas in meadows, but can be associated with sparse willow cover (Hudak et al., 1994 draft). In this eastern Sierra study *Muhlenbergia richardsonis* was found most frequently in the *Carex utriculata, Carex nebrascensis*, Mesic graminoid, *Poa cusickii ssp. epilis,* Dry graminoid, *Artemisia cana*/Mesic graminoid, Warm willow/Gravel bar, Cold willow/Mesic graminoid, and *Pinus contorta ssp. murrayana*/Mesic graminoid ecological types. In Colorado mat muhly is sometimes abundant on heavily grazed bottomlands where gully erosion has lowered the water table and impaired soil fertility to such an extent that sites have become unfavorable for bluegrasses and other grasses which formerly occupied those areas (USDA, 1937). It recovers rather well from close grazing early in the growing season (Crampton, 1974).

F-14

Muhlenbergia richardsonis (Trin.) Rydb. - Mat muhly

Illustration by Jeanne R. Janish reprinted with permission from *Intermountain Flora Vascular Plants of the Intermountain West, U.S.A.* vol. 6, A. Cronquist et al., copyright 1977, The New York Botanical Garden.



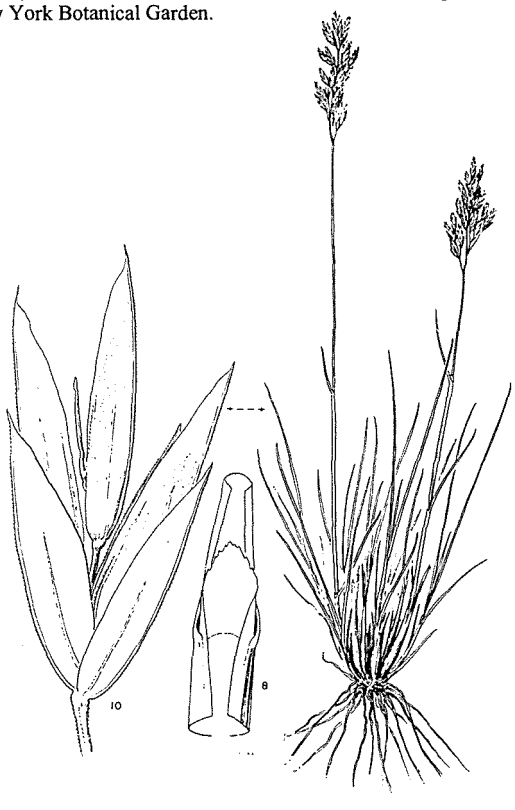
Poa cusickii Vasey - Cusick bluegrass

Poaceae (aka. in part *Poa epilis* (Scribner) W.A. Weber, Skyline bluegrass)

Densely cespitose to sparsely tufted perennial. Stems 1-6dm with leaf sheath open part of the length. Leaves 6-20cm long, bright green, usually folded or sometimes involute in drying, 1-3mm broad; ligules 1.5-5mm long, sometimes long attenuate; panicles 2.5-7 cm long, usually condensed, ovoid or oblong, usually deep purple but sometimes green; spikelets 5-9mm long, strongly compressed, 2 to 5 flowered; florets usually pistillate; glumes shorter than the florets, the first 2.2-4.5mm long, the second 2.8-5mm; lemmas 4-6mm long often minutely scabrous, acute, with scarious margins and apex, not cobwebby at the base. Most of our occurrences key to *Poa cusickii ssp. epilis* in Hickman, 1993.

Moist to dry meadows, sagebrush scrub, montane forest, moist subalpine, especially in snowpockets (Hickman, 1993). Subalpine and alpine meadows or rocky ridges and slopes (Cronquist et al., 1977b). The *Poa cusickii* ssp. *epilis* ecological type is often located in open, exposed drainageways at high elevation. *Poa cusickii* is also frequently encountered in the *Carex scopulorum*, Mesic graminoid, *Artemisia cana*/Mesic graminoid, and *Salix eastwoodiae* ecological types.

Illustration by Jeanne R. Janish reprinted with permission from *Intermountain Flora Vascular Plants of the Intermountain West, U.S.A.* vol. 6, A. Cronquist et al., copyright 1977, The New York Botanical Garden.



Poa pratensis ssp. pratensis L. - Kentucky bluegrass

Poaceae

Perennial from long, stout rhizomes, 2-7dm. Leaf sheath open 1/2 to 3/4 length; ligule 1-3mm, truncate, smooth to minutely scabrous at margin; blade 1.5-3mm wide, firm, flat or folded; the tips strongly boat-shaped. Inflorescence an ovate to pyramidal panicle, 6-15cm long. Spikelets 2-4 flowered, 4-5mm long, strongly compressed. Lemmas 2.5-4mm long with copious cobwebby hairs at the base; glumes 1.8-3.3mm, scabrous on the keel.

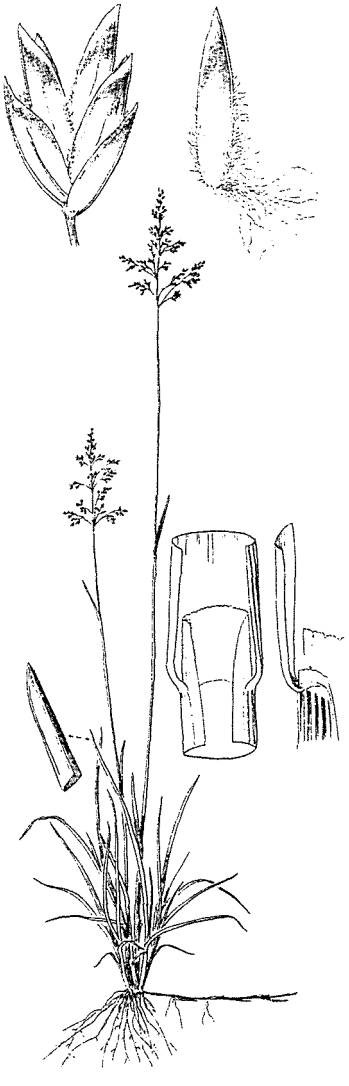
Robert Soreng recognizes a subspecies of *Poa pratensis*, which he believes is native to the Sierra Nevada in that it shares more genetic links to mountainous North American native species than with the European introduced *Poa pratensis ssp. pratensis*. Field characteristics of *Poa pratensis ssp. agassizensis* are a dense inflorescence, less than 6cm long with smooth branches; leaves that are firm and folded; and sparsely soft-hairy upper surfaces to the leafblades of nonflowering shoots. Both subspecies were found in our study area in the Eastern Sierra.

Common in many disturbed and stable habitats, including saline and alkaline soils below 3500m. Widely planted as pasture grass (Hickman, 1993). Moderately moist to dry roadsides, meadows and open woods (Cronquist et al., 1977b). It thrives best on well-drained loams or clay loams which are preeminently rich in humus. Frequently found on wet soils, but does not thrive on acid soils and it cannot survive on water-logged sites. Ordinarily inhabits the richer mountainous soils and moister sites, often occurring in meadows, along water courses and in the more or less open and semishaded benchlands. Kentucky bluegrass is not tolerant of saline soil conditions. Optimum soil pH is between 5.8 and 8.2. It is usually found on sites that are moist in the spring and dry by mid-summer (Hudak et al., 1994 draft). Water tables in communities dominated by Kentucky bluegrass are usually below 50cm (Youngblood et al., 1985). Becomes dormant if the upper 20cm of the soil does not stay moist. Shade tolerant under willows, birch and aspen. In the study area *Poa pratensis* was frequently found in all ecological types described in the Eastern Sierra Riparian Field Guide.

As a major forage species of mountain meadows, it tolerates close grazing and much trampling, recovering via its extensive rhizomes (Crampton, 1974). Very nutritious and palatable forage for all classes of grazers available throughout the summer if temperatures do not get too warm. Sod grass is very resistant to heavy utilization and trampling. May not only maintain itself but increase the stand under these conditions. Does not endure prolonged summer heat and drought. Commercial seed is readily available; it seeds well, forming a sod which prevents erosion. Establishment requires precipitation over 20 inches and preferably moisture through the growing season. Kentucky bluegrass produces an abundance of slender, creeping rootstocks and a profusion of deep fibrous roots which often penetrate the soil to a depth of 3 to 4 feet (USDA, 1937). Energy is directed into the below ground biomass which can be up to ten times the above ground biomass, primarily within the upper 10cm of soil (Hudak et al., 1994 draft). Production and vigor of existing stands can be improved by use of a grazing system that reduces flowering and promotes tiller development by deferring grazing until bluegrass reaches approximately 10cm height and providing periodic rest (Volland, 1978 in Manning and Padgett, 1995). With its shallow root system, Kentucky bluegrass provides little protection for streambanks (Hansen et al., 1988) and bank failure is common on bluegrass sites. Bluegrass dominated streambanks will not develop stable overhanging banks important

for fisheries habitat. Dense sod does protect the soil surface of floodplains from lateral sheet erosion (Hudak et.al, 1994 draft).

Illustration by Jeanne R. Janish reprinted with permission from *Intermountain Flora Vascular Plants of the Intermountain West, U.S.A.* vol. 6, A. Cronquist et al., copyright 1977, The New York Botanical Garden.



Poa secunda ssp. juncifolius (Scribner) R. Soreng - Nevada bluegrass

Poaceae (aka. *Poa nevadensis* Scribner)

Densely cespitose perennial 3-12dm. Leaf blade generally less than 1.5mm wide, tightly folded and inrolled, stiffly ascending, often glaucus; ligule 0.5-6mm, truncate to acuminate, scabrous, decurrent, running into the margins of the sheathes. Inflorescence generally linear to lanceolate, dense often one-sided panicle. Branches are appressed to ascending, only spreading in flower, 6-25cm long. Two to six florets in little-compressed spikelet; lemma 3.5-6mm, glabrous, weakly keeled to rounded.

Sagebrush shrubland to lower montane forest often in alkaline depressions at 900-3000m elevation (Hickman, 1993). Relatively moist places in sagebrush valleys and edges of meadows at middle elevations (Cronquist et al., 1977b). Above 4000ft, dry to moist mountain meadows or occasionally rocky slopes (Crampton, 1974). On plains, dry meadows, and open hillsides preferring open woods of slopes and foothills. Frequently, however, it is found along partially shaded streambanks and creek bottoms. Grows luxuriantly and densely on rich soils of moist situations, but most common on relatively infertile, loose, sandy or loamy soils. Most drought enduring of the bluegrasses (USDA, 1937). Rarely occurs in wet riparian or wetland habitats. Found in moist swales and riparian meadows, in enclosed claypan depressions, along ephemeral streams and on moist north facing slopes at higher elevations. Wide range of soil tolerance. Typically occurs on soils having a restrictive clay subsoil. Soil temperatures are mesic and frigid. Production is best on moist soils (Hudak et al., 1994 draft). Nevada bluegrass dominated communities are typically found on sites that are moist in spring, drying through summer (Manning and Padgett, 1995). In the eastern Sierra the species was frequently found on *Carex nebrascensis*, Mesic graminoid, Dry graminoid *Artemisia cana*/Mesic graminoid, and Warm willow/Gravel bar ecological types. Valuable forage prior to flowering (Crampton, 1974). Reduced by grazing and trampling. Spreads by seed almost exclusively (USDA, 1937). Provides less surface erosion control than rhizomatous grasses, but may have value in protecting ephemeral channels and drainageways where few other grasses grow (Hudak, et al., 1994 draft).

Poa secunda ssp. juncifolius (Scribner) R. Soreng - Nevada bluegrass

Illustration by Jeanne R. Janish reprinted with permission from *Intermountain Flora Vascular Plants of the Intermountain West, U.S.A.* vol. 6, A. Cronquist et al., copyright 1977, The New York Botanical Garden.

F-20

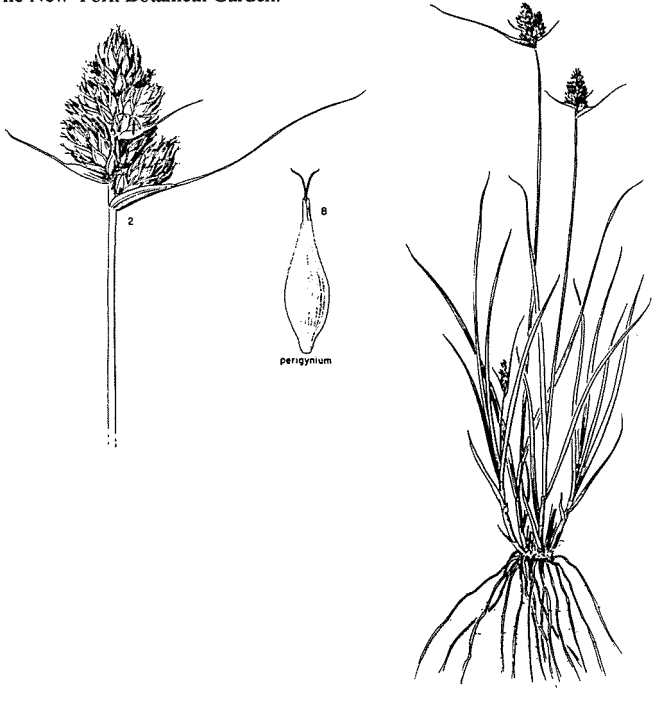
Carex athrostachya Olney - Slenderbeak sedge

Cyperaceae

Densely tufted stems and leaves; without rhizomes, 1.5-10dm tall; leaves flat or nearly so 1.5-4mm wide mostly shorter than the culms and loosely arranged on the lower half of the culm. Flower spikes sessile and crowded at the top of the culm into a globose head 1-2cm long. The lowest bract below the head elongated and generally longer than the head. Perigynia flattened or somewhat plano-convex lanceolate, lightly nerved on the upper surface, with a winged margin and tapering to a beak. Achenes lenticular, stigmas 2.

Seasonally moist meadows, marshes, 100-3200m (Hickman, 1993). Occurs at low to mid elevations in wet basins, seasonally flooded areas, lake and pond margins and wet meadows and thickets. Found on a variety of mesic and frigid soils ranging from fine textures to sandy mineral soils as well as organic soils and occasionally alkaline soils. Soils are generally subirrigated, moist, but not saturated, with water tables ranging from 40cm to well below a meter (Youngblood et al., 1985). Sites may also be inundated during the spring and early summer, drying by mid summer. Can also be found as an early colonizer of stream bars, since it reproduces primarily by seed. It may later be replaced by rhizomatous species. *Carex athrostachya* was sampled most frequently in the *Carex nebrascensis*, Mesic graminioid, *Poa cusickii ssp. epilis, Artemisia cana*/Mesic graminoid, Warm willow/Gravel bar and Cold willow/Mesic graminioid ecological types. Not a very good forage species and not resistant to trampling or grazing. It is valuable for waterfowl cover and food, but not for fisheries habitat (Hudak, et al., 1994 draft).

Illustration by Jeanne R. Janish reprinted with permission from *Intermountain Flora Vascular Plants of the Intermountain West, U.S.A.* vol. 6, A. Cronquist et al., copyright 1977, The New York Botanical Garden.



Carex douglasii Booth - Douglas sedge

Cyperaceae

Short, (1-3dm) dioecious perennials from creeping, brown rhizomes. Leaves folded or inrolled at margin, thick, 1-2.5mm wide; sheath mount with thick rim. Flowers borne in dense terminal heads 1.5-3.5cm long by 1.3-2.7cm wide. Perigynia appressed, 3.5-4.6mm long, 1.3-1.8mm wide, many veined, tapered to tip, gold to medium brown, beak 0.9-1.8mm, tip with narrow white margin. Achene 1.4-1.9mm long by 1-1.5mm wide.

Dryish sandy, gravelly or alkaline areas, 300-3800m (Hickman, 1993). Dry to fairly wet places, often with sagebrush but not in drier parts of the desert, from valleys and plains to moderate elevations in the mountains, tolerant of alkali (Cronquist et al., 1977b). Inhabiting meadow borders and other semimoist soils in the transition zone between dryland vegetation and wet meadows (USDA, 1937). Upland species on sites that are moist in spring or retain some moisture through the year because of fine texture soils. In riparian areas, it is found only in the driest riparian sites at low to mid elevations. Soils are generally fine textured clays to silt loams, sometimes alkaline and often compacted. Water tables in Douglas sedge sites are a meter or more below the surface (Manning and Padgett, 1995). Found most frequently in Dry graminoid, *Artemisia cana*/Mesic graminoid, and Warm willow/Gravel bar ecological types. *Carex douglasii* is not highly palatable to livestock (Cronquist et al., 1977b). Rhizomatous root systems make the plant very resistant to grazing (USDA, 1937). Douglas sedge dominated communities are thought to be grazing induced. *Carex douglasii*'s slender rhizomes may not withstand heavy trampling damage. Once the sod is broken, erosion by surface flow is possible (Manning and Padgett, 1995).

F-22

Carex douglasii Booth - Douglas sedge

Illustration by Jeanne R. Janish reprinted with permission from *Intermountain Flora Vascular Plants of the Intermountain West, U.S.A.* vol. 6, A. Cronquist et al., copyright 1977, The New York Botanical Garden.

Carex heteroneura W. Boott - Variable-nerved sedge

Cyperaceae (aka . *Carex atrata* L. *var. erecta* W. Boott)

Cespitose 2.5-10dm. Leaf blades 2-4mm wide. Inflorescence more or less dense, not head-like; terminal spikelet generally pistillate above; lowest spikelets generally erect, generally conspicuously 2-colored; pistillate floral bract generally more than 1.2mm wide, dark purple or with a pale midstripe. Perigynia ascending green or purplish above, 3-sided but flat around fruit 2.5-3.9mm long, 1.4-2.5mm wide with flat margin less than 0.4mm.; body of perigynium is elliptic to obovate more or less rounded at tip with a beak 0.2-0.5mm.

Wet meadows, forest openings, rocky slopes 1800-3800m (Hickman, 1993). Wet meadows to open, rather dry slopes, at moderate to high elevations in the mountains (Cronquist et al., 1977b). In the study area the species was found in the *Carex scopulorum*, *Poa cusickii ssp. epilis*, and *Pinus contorta ssp. murrayana*/Mesic graminoid ecological types.

Illustration by Jeanne R. Janish reprinted with permission from *Intermountain Flora Vascular Plants of the Intermountain West, U.S.A.* vol. 6, A. Cronquist et al., copyright 1977, The New York Botanical Garden.

F-24

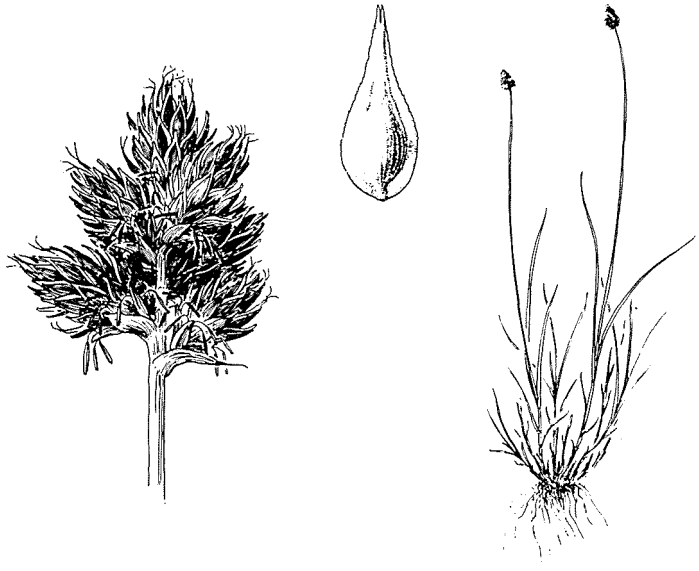
Carex microptera Mackenzie - Smallwing sedge

Cyperaceae (aka. *C. festivella* Mackenzie, Ovalhead sedge)

Stems erect but less than 20cm tall, tufted, without creeping rhizomes. Leaves flat, or nearly so, 2-6mm wide, generally shorter than the culms. Flowers born in dense green to brownish, compact, globose-ovoid heads, 12-25mm long. Perigynia ascending and spreading 2.9-5mm, 1-2.2mm wide, flat but sometimes planoconvex, inflated, veined, green to gold in color, center often brown, winged and beaked. Fruit lenticular 1.1-1.5mm.

Moist or wet places, from foothills to moderately high elevations in the mountains, seldom approaching timberline (Cronquist et al., 1977b). Common in meadows 1500-3400m (Hickman, 1993). Grows in moist situations but not in shallow water or swamps. Prefers sites such as meadows and springy slopes, especially at higher elevations, growing on deep, loamy soils in meadows, but also common on shallow and rocky soils on slopes and about springs. May appear on hummocks or elevated spots in bogs and swampy areas. Normally in full sun, but sometimes fair stands occur in shade. Most common above the ponderosa pine belt and below timberline (USDA, 1937). Most frequently encountered in riparian areas of the *Carex nebrascensis*, *Carex scopulorum,* Mesic graminoid, *Poa cusickii ssp. epilis*, Warm willow/Floodplain, Cold willow/Mesic graminoid, *Populus tremuloides*/Mesic graminoid, and *Populus tremuloides*/Tall forb ecological types. Only moderately palatable to livestock and is sensitive to grazing (Cronquist et al., 1977b).

Illustration by Jeanne R. Janish reprinted with permission from *Intermountain Flora Vascular Plants of the Intermountain West, U.S.A.* vol. 6, A. Cronquist et al., copyright 1977, The New York Botanical Garden.



Carex nebrascensis Dewey - Nebraska sedge

Cyperaceae

Coarse, stout, sod-forming perennial to 9dm, from stout, deep, creeping rhizomes. Stems sharply triangular, leaves predominantly from near the base. Leaves blue-glaucous, firm, flat, typically 4-10mm wide, with a W-shaped cross-section. Flowers borne in 3-6 long cylindrical spikes per stem, terminal spikes staminate. Lowest floral bract, leaflike, equalling or exceeding the spikes in length. Perigynia lens-shaped, 3-4mm long including the beak, the surface prominently 5-10 nerved on both faces. Lenticular achene; stigmas 2.

Wet to moist meadows, marshes, lodgepole pine wetlands, streambanks and ditches (Kovalchick et al., 1988). Meadows and swamps below 2500m (Hickman, 1993). Wet sites along slow streams, near springs, in shallow, swampy areas and wet meadows. Found in ephemeral drainageways with subirrigation. Generally found in water deposited loams or highly organic, often peatlike, marshy soils, although sometimes in wet gravelly soil (USDA, 1937). Wet meadows and other wet places, often in alkaline situations, from lowlands to moderate elevations. Readily tolerates dry air and intense sunlight so long as its feet are wet (Cronquist et al., 1977b). Soil temperatures include mesic and frigid and occasionally cryic. May be found with other graminoids or as an understory under willows (Hudak et al., 1994 draft). Sites are drier than those supporting *C. utriculata*; water table may drop below the surface, sometimes to a meter during the later part of the growing season (Manning and Padgett, 1995). Found frequently in all riparian ecological types of the eastern Sierra except *Populus tremuloides*/Mesic graminoid, and *Populus tremuloides*/Tall forb.

Regenerates by rhizome extension primarily (Kovalchick et al., 1988). Well adapted to withstand grazing, continuing to grow through summer if moisture is available (USDA, 1937). Seedling establishment is rare and often dependent on recently deposited moist substrates (Hudak et al., 1994 draft) Annual production is high, up to 600g/m^2. Nebraska sedge forms a dense deep root system, with root biomass of up to 3000g/m^2 in the top 20cm of the soil (Manning et al., 1989). Dense roots provide excellent resistance to soil compaction and erosion. Stable overhanging banks may be formed of Nebraska sedge. Nebraska sedge also provides food and shelter for terrestrial wildlife. Transplanting rhizomes is probably the best way of planting this species for restoration (Hudak et al., 1994 draft).

F-26

Carex nebrascensis Dewey - Nebraska sedge

Illustration by Jeanne R. Janish reprinted with permission from *Intermountain Flora Vascular Plants of the Intermountain West, U.S.A.* vol. 6, A. Cronquist et al., copyright 1977, The New York Botanical Garden.

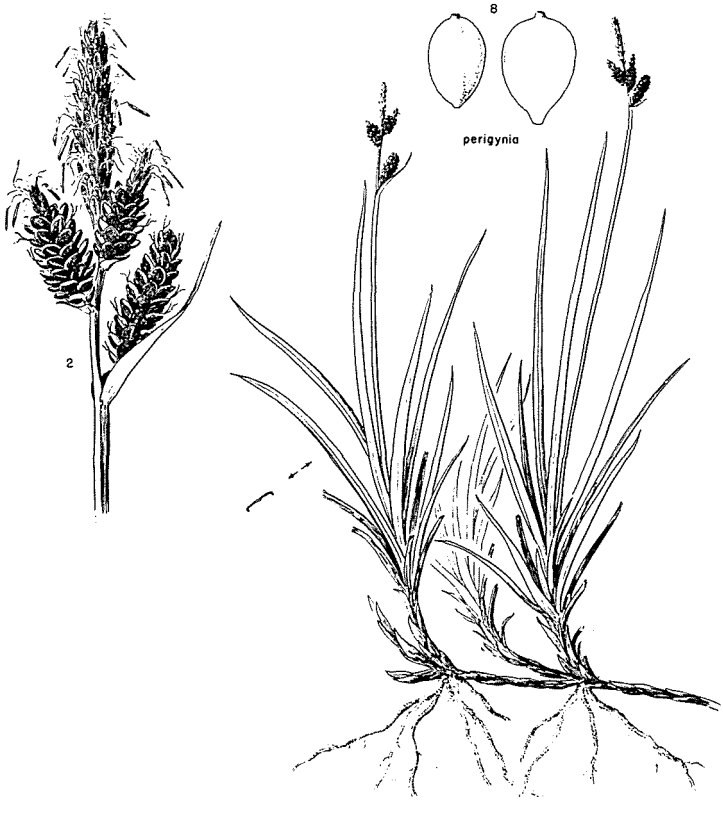
Carex scopulorum Holm var. ***bracteosa*** (L. Bailey) F. Herm. - Mountain sedge

Cyperaceae (aka. *C. gymnoclada* Holm)

Plants 1-4dm tall, sod-forming, with freely branched rhizomes and scattered or loosely clustered stems; leaves firm, flat or nearly so, mostly 2-6mm wide, less than 3dm long. Bracts shorter than the inflorescence; spikes mostly 3-6, the terminal one most often staminate the others pistillate, all cylindric, erect, mostly 1-2.5cm long. The lowest spikelet 8-30mm, its bract less than half as long as the inflorescence. Pistillate scales black, or blackish-purple to dark reddish-brown, generally scarious. Perigynia elliptic to obovate, often broadly so, purple above, strongly papillate; compressed but somewhat inflated distally, mostly 1.8-3.3mm long; fruit dull.

Wet places (Hickman, 1993). Wet meadows, streambanks, lakeshores, and moist, open slopes, at middle and upper elevations in the mountains, often above timberline (Cronquist et al., 1977b). In the eastern Sierra this species was found in the *Salix eastwoodiae* and Cold willow/Mesic graminoid ecological types as well as in the *Carex scopulorum* ecological type .

Illustration by Jeanne R. Janish reprinted with permission from *Intermountain Flora Vascular Plants of the Intermountain West, U.S.A.* vol. 6, A. Cronquist et al., copyright 1977, The New York Botanical Garden.



F-28

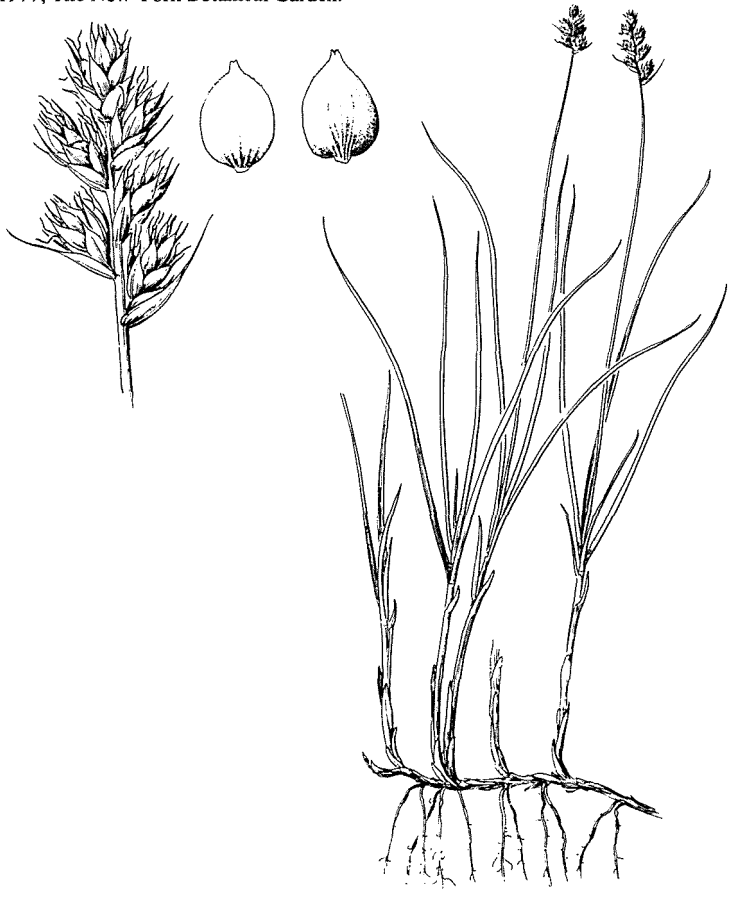
Carex simulata Mackenzie - Shortbeak sedge

Cyperaceae

Short (2-9dm) culms arising singly or few together from thick, brownish, long rhizomes; leaves flat or nearly so, 1-5mm wide, often much elongate; spikes 8-25 or more, sessile, short, less than 1cm long, aggregated into a terminal, ovoid to subcylindric head 1.5-3cm long and up to 1.5 cm wide, the spikes more or less distinguishable to the naked eye. Perigynia relatively small, only 1.7-2.4 mm long, plano-convex, shining brown, hard, short-beaked.

Found in moist soil (Hickman, 1994). Wet meadows, from foothills to moderate elevations in the mountains, not reaching timberline. Widespread but not especially common (Cronquist, 1977b). In the eastern Sierra this species was found in *Carex nebrascensis*, *Carex scopulorum*, Mesic graminoid, *Poa cusickii ssp. epilis*, *Artemisia cana*/Mesic graminoid, *Salix eastwoodiae* and Cold willow/Mesic graminoid ecological types.

Illustration by Jeanne R. Janish reprinted with permission from *Intermountain Flora Vascular Plants of the Intermountain West, U.S.A.* vol. 6, A. Cronquist et al., copyright 1977, The New York Botanical Garden.



Carex utriculata Boott - Beaked sedge

Cyperaceae (aka. *C. rostrata* Stokes)

Coarse, stout perennial to 1.2m tall, from deep-seated rhizomes. Stems sharply triangular, leafy throughout. Leaves stout, 4-12mm wide, strongly scabrous. Flowers borne in 3-6 stout cylindrical spikes per stem, terminal 1-3 spikes staminate, pistillate spikes 2-10cm long and about 1cm wide (resembling a corncob). Lowest floral bract leafy and typically much longer than the inflorescence. Perigynia crowded, strongly spreading at maturity, inflated, nerved, abruptly beaked, 4-7mm long. Triogonous achene, stigmas 3.

Seasonally to permanently flooded basins, active floodplains, wet meadows and streambanks; low to moderately high elevations (Kovalchick et al., 1988). In wet soil or shallow water at margins of streams, lakes and ponds, sometimes in swamps or wet meadows, from lowlands to moderate elevations in the mountains (Cronquist et al., 1977b). Common in wet places and shallow water (Hickman, 1993). Beaked sedge occurs from low to moderately high elevations along low gradient streams in wide valleys, beaver ponds, backwater and oxbows and in seeps. Soils are usually fine textured. Older stands are found on organic soils but the species can also colonize recently deposited silts, such as those found on beaver ponds or along stream channels (Youngblood et al., 1985). Densest stands develop on sites that are shallowly flooded throughout the year (Ratliff and Westfall, 1988). On non-flooded sites, water tables are usually within the rooting zone throughout the year (Manning and Padgett, 1992 draft). Can tolerate fluctuating water levels and inundation (Hudak et al., 1994 draft). Associated species include grasses and other sedges or cold willows (Manning and Padgett, 1992 draft). In our study area the species was only found in the *Carex utriculata* and *Pinus contorta ssp. murrayana/Salix spp.* ecological types.

Plants rapidly regenerate by rhizome extension into new sediments (Kovalchick et al., 1988). Important in soil formation, especially on boggy and wet sites. Ungrazed rank growth accumulates year after year to produce peaty soil. Rhizomes and stems catch sediments and hold them in place (USDA, 1937). Willows become more common as sites dry due to channel downcutting or pond filling (Hansen et al., 1988). Not very important as a forage species due to flooded site conditions. Tolerates light grazing, increasing shoot production as a response. Susceptible to fall grazing impacts due to low reserves. Excellent cover for nesting waterfowl and small mammals. Seeds used by wildlife. Root mat is strong enough to provide overhanging banks for fish habitat (Hudak et al., 1994 draft) and inundated areas are good rearing areas for fry.

F-30

Carex utriculata Boott - Beaked sedge

Illustration by Jeanne R. Janish reprinted with permission from *Intermountain Flora Vascular Plants of the Intermountain West, U.S.A.* vol. 6, A. Cronquist et al., copyright 1977, The New York Botanical Garden.

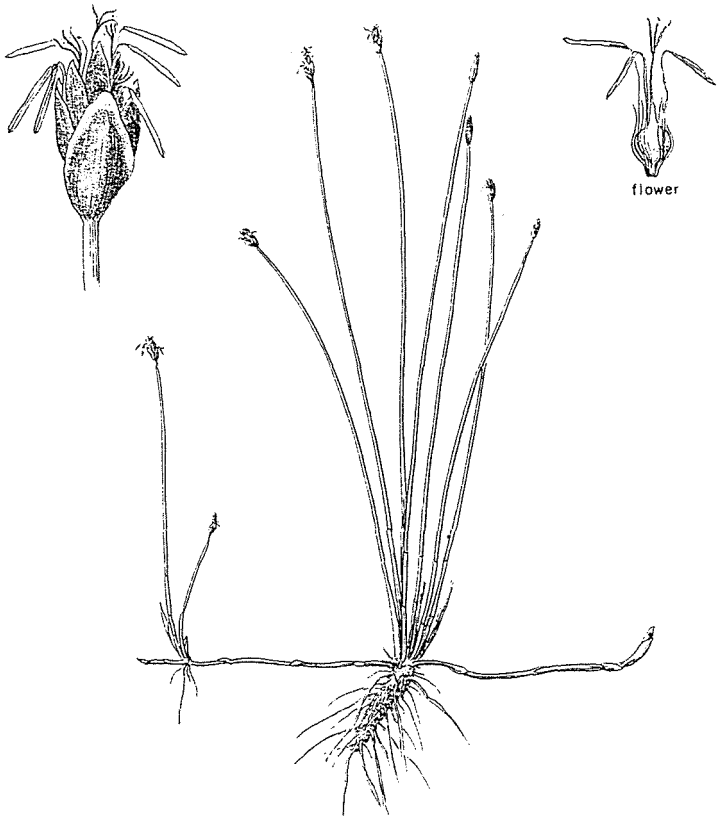
Eleocharis pauciflora (Light)Link - Fewflower spikerush

Cyperaceae

Perennial to 3dm tall, clustered on short to long rhizomes; stems terete, slender, seldom as much as 1mm thick, leafless. Flowers in a single, terminal, 3-9 flowered spikelet, 4-8mm long. Achene broadest above the middle, 1.9-2.6mm long including the short stylar beak; stigmas 3.

Present in many meadow associations but characteristic of bog-forming sites; moderate to high elevations (Kovalchick et al., 1988). Boggy or otherwise wet places, from lowlands to high elevations in the mountains, sometimes above timberline; tolerant of salt and alkali (Cronquist et al., 1977b). In eastern Sierran riparian areas *Eleocharis pauciflora* was frequently encountered in *Carex utriculata, Carex nebrascensis*, Mesic graminoid, Warm willow/Gravel bar and *Salix eastwoodiae* ecological types.

Illustration by Jeanne R. Janish reprinted with permission from *Intermountain Flora Vascular Plants of the Intermountain West, U.S.A.* vol. 6, A. Cronquist et al.. copyright 1977, The New York Botanical Garden.



Juncus balticus Willd. - Baltic rush

Juncaceae (aka. Wiregrass)

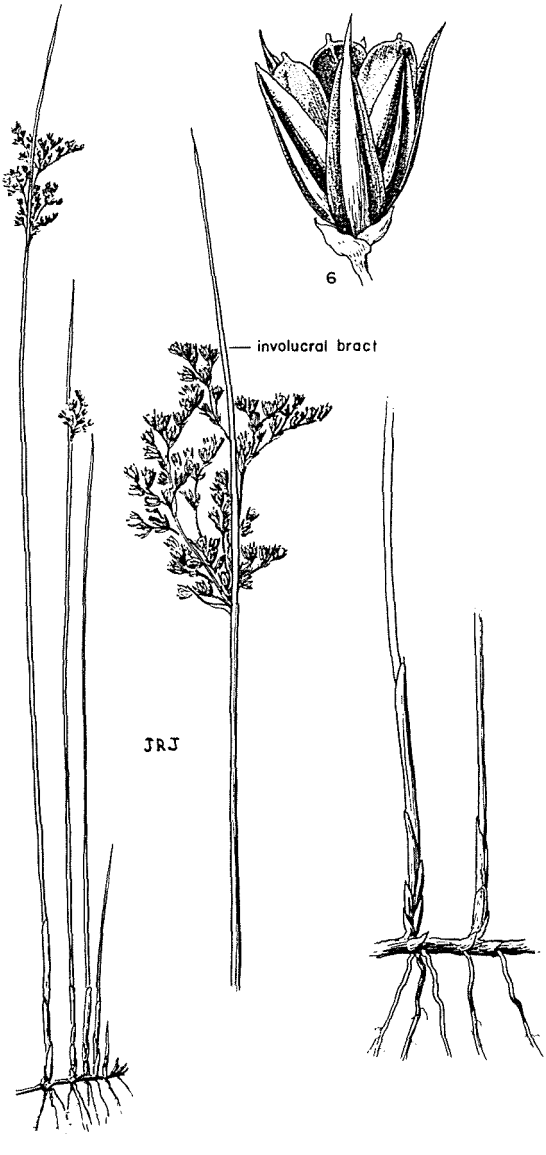
Vigorous rhizomatous perennial to 6dm tall; stems wiry, form, 1.5-3mm thick. Leaves largely reduced to bladeless sheaths. Ten to 50 flowers in a compact to loose inflorescence, emerging from the side of the culms; floral bract terete, 5-20cm long. Fruit an ovoid capsule.

Moist meadows and marshes at low to moderate elevations (Kovalchick et al., 1988). Low, wet, often alkaline places, from valleys and plains up to middle elevation in the mountains (Cronquist et al., 1977b). Wet meadows, ponds, lakes, streams and rivers from valleys to moderate elevations; often in saline or alkaline sites (Hurd et al., 1994). Moist to rather dry places below 2200m (Hickman, 1993). Prefers moist or wet, deep, organic meadow soils. Also frequently common in shallow ponds, where water may stand until midsummer or longer, but is also occasionally found in rather dry situations such as sage flats and dry meadows. Grows on soils which are either shallow or gravelly or a combination of both if moisture is adequate. Dry site soils it inhabits are usually deep and fertile. Cold organic soils it inhabits tend to be acidic while throughout its range it also grows in neutral or alkaline soils (USDA, 1937). Water tables on sites supporting Baltic rush range from near the surface to as much as 3m below the surface on incised meadows. Soils range from silt and clay loams to coarser substrates or peat soils (Hudak et al., 1994 draft). *Juncus balticus* was frequently found in all eastern Sierran riparian ecological types except the Aspen types.

Juncus balticus tends to dominate overused pastures, replacing PNC dominants (Kovalchick et al., 1988). Spring growth is somewhat palatable for livestock provided it comprises less than 20% of the composition of forage on site. Very resistant to grazing because of persistent, deep rhizomes as well as extensive fibrous roots. Excellent soil binding properties make this a valuable erosion control species (USDA, 1937). Baltic rush has been found to fix atmospheric nitrogen and may be important in the nutrient dynamics of the wetland plant communities in which it is common. Nutrient content of hay is quite high. Provides good cover for waterfowl, songbirds and small mammals. May be rapidly established from transplanting rhizomes or from commercially available seed (Hudak, et al., 1994 draft).

Juncus balticus Willd. - Baltic rush

Illustration by Jeanne R. Janish reprinted with permission from *Intermountain Flora Vascular Plants of the Intermountain West, U.S.A.* vol. 6, A. Cronquist et al., copyright 1977, The New York Botanical Garden.



F-34

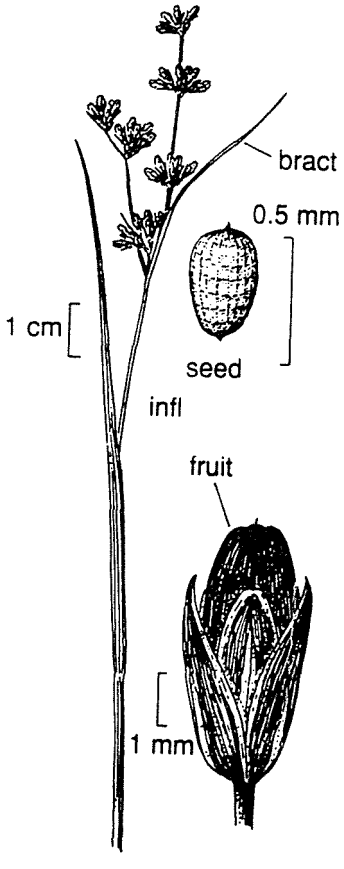
Juncus covillei (Piper) ***var. obtusatus*** (Englm.) C.Hitchc.

Juncaceae

Cespitose perennial from heavy creeping rhizomes, 5-25cm tall. Leaves mostly basal, blades with flat side toward the stem, reaching the same height as the inflorescence, 2-4mm wide. Inflorescence with 1-5 branches, supporting 10-15 clusters, each cluster 3-7 flowered. Perianth segments pale brown, 2-3.5mm, middle papillate brown or green. Fruit barely longer than the perianth, widely cylindric, pale brown with tip that is beaked and more or less notched.

Montane forests and other moist places between 500 and 3000m (Hickman, 1993). In the eastern Sierra this rush species is frequently found in *Carex utriculata*, Dry graminoid, *Artemisia cana*/Mesic graminoid and Cold willow/Mesic graminoid ecological types.

Illustration of *Juncus covillei var. covillei* by Linda Ann Vorobik reprinted from *The Jepson Manual*, J. Hickman, Ed., 1993, with permission from the Jepson Herbarium, copyright Regents of the University of California.



Juncus nevadensis S. Watts

Juncaceae

Stems generally scattered on elongate rhizomes, terete, 2-7dm tall. Leaves mostly 5-25cm long, terete, hollow. The sheath prolonged into a pair of evident auricles 1-3mm long. Inflorescence of 4-30 heads each 5-10mm thick, usually longer than the lowest bract. Flowers several > 7 per head. Tepals dark to light brown or purplish-brown, often evidently hyaline-margined.

Wet meadows, streambanks and marshes from the valleys to middle elevations in the mountains (Cronquist, et al., 1977b). Common in mountain meadows and on stream-banks 1200-3300m. (Hickman, 1993). Commonly encountered in the Mesic graminoid, *Poa cusickii ssp. epilis,* and Warm willow/Floodplain ecological types of the eastern Sierra Nevada. Important forage for cattle and horses (Hickman, 1993).

F-36

Juncus nevadensis S. Watts

Illustration by Jeanne R. Janish reprinted with permission from *Intermountain Flora Vascular Plants of the Intermountain West, U.S.A.* vol. 6, A. Cronquist et al., copyright 1977, The New York Botanical Garden.

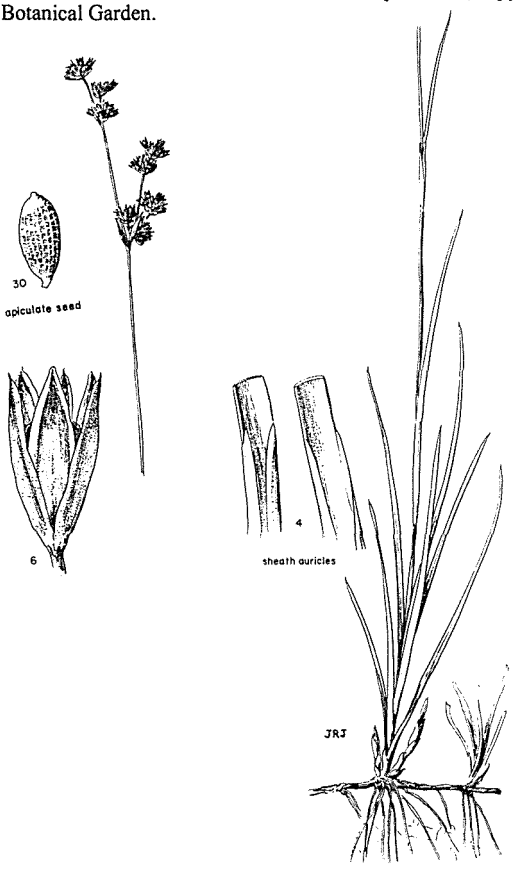
Juncus orthophyllus Cov. - Straightleaf rush

Juncaceae

Perennial, 2-5dm tall from a hard, dark, scaly, creeping rhizome; leaves mostly basal with the flat side of the blade oriented toward the stem, more or less as long as the stem, 2-6mm wide. Cauline leaves 1-3 above the middle. Inflorescence open with 1 to many 6-10 flowered hemispheric clusters. Perianth segments 5-6mm long, papillate, bristle-tipped, middle green, margins brown. Fruit slightly shorter than the perianth with flat tip and small beak.

Inland wet places, especially meadows, streambanks in forest 1200-3500m (Hickman, 1993). Meadows and streambanks from valleys and foothills to middle elevations in the mountains (Cronquist et al., 1977b). In our study area found most frequently in *Carex utriculata*, *Carex nebrascensis*, *Carex scopulorum,* Mesic graminoid, *Artemisia cana*/Mesic graminoid, *Salix eastwoodiae,* Cold willow/Mesic graminoid and *Pinus contorta ssp. murrayana*/Mesic graminoid ecological types.

Illustration by Jeanne R. Janish reprinted with permission from *Intermountain Flora Vascular Plants of the Intermountain West, U.S.A.* vol. 6, A. Cronquist et al., copyright 1977, The New York Botanical Garden.



F-38

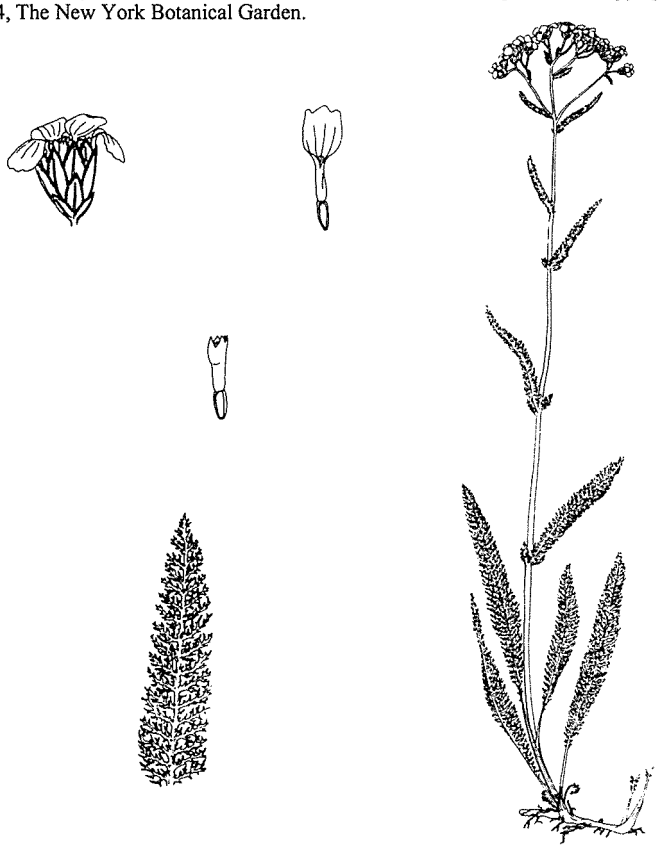
Achillea millefolia L. - Common yarrow

Asteraceae (aka. milfoil, wild-tansy)

Strongly scented perennial. Leaves alternate, finely 3-pinnately divided, more or less hairy. Heads many, in float topped clusters; phyllaries 4-9mm; ray flowers 3-8, ligules 2.5-4mm, round, white to pink; disk flowers 15-40, corollas 2-3mm, white to pink.

Prospers in a great variety of habitats, such as sagebrush areas, canyon bottoms, glades, roadsides, vacant lots. It is prevalent in brushlands, aspen and open timber, but avoids dense shade. It is comparatively drought-resistant and flourishes in the sandy and gravelly loam soils of open flats, parks, and dry meadows. In the eastern Sierra the species was found on all ecological types. Invades readily and increases conspicuously when overgrazing makes growing conditions unfavorable for more palatable and less resistant species. When planted near the edge of small gullies, roots spread down and catch sediment from water flowing past them. In addition to spreading by rhizomes, the species is a good seed producer (USDA, 1937).

Illustration by John H. Rumely reprinted with permission from *Intermountain Flora Vascular Plants of the Intermountain West, U.S.A.* vol. 5, A. Cronquist et al., copyright 1994, The New York Botanical Garden.



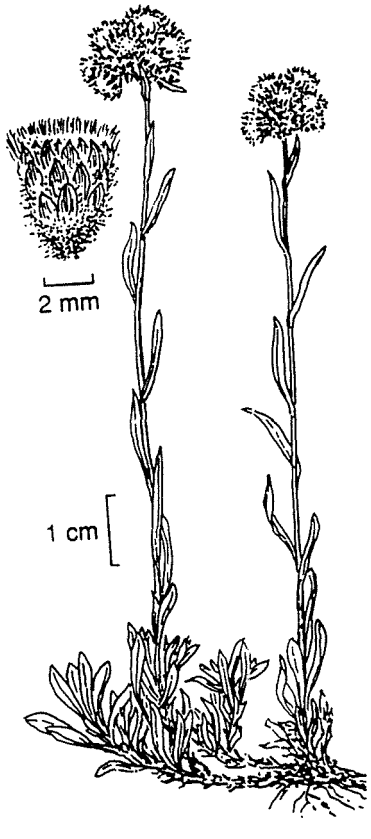
Antennaria rosea E. Greene - Rose pussytoes

Asteraceae

Matted perennial 9-40cm, arising from short stolons. Basal leaves 8-40mm, spoon to wedge shaped, 1-veined, more or less gray tomentose. Cauline leaves 6-36mm. Involucre 3.5-7.5mm, base hairy; phyllaries wide, acute, tips white, rose, yellowish or brownish. Corollas 2.5-5.5mm, reddish, white or sometimes yellowish.

Woods, meadow edges, rock barrens and dry ridges, 1200-3700m (Hickman, 1993). In riparian settings of the eastern Sierra this species is most frequently found in *Carex utriculata, Carex scopulorum*, Mesic graminoid, *Artemisia cana*/Mesic graminoid, and *Pinus contorta ssp. murrayana*/Mesic graminoid ecological types.

Illustration of *A. rosea ssp. confinis* by Emily E. Reid reprinted with permission from *The Jepson Manual*, J. Hickman, Ed., 1993, with permission from the Jepson Herbarium, copyright Regents of the University of California.



F-40

Arnica chamissonis Less. ssp. ***foliosa*** (Nutt.) Maguire - Chamisso arnica

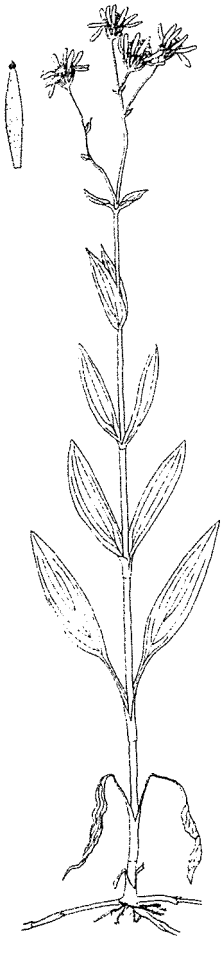
Asteraceae (aka. *A. foliosa* (Nutt.))

Perennial from long, nearly naked rhizomes; single stems 2-10dm tall; herbage hairy or subtomentose; leaves generally 5-10 pairs equally spaced up the stem, 1-4cm wide and 5-30cm long. Up to 15 flower heads each 8-13mm long in terminal raceme; ray flowers pale yellow, 1.5-2cm long; disk corollas slender 7-11mm long .

Mostly in meadows and wet places, from foothills to middle or upper-middle elevations in the mountains 1300-3000m. Within this subspecies is the variety *incana* (A.Gray) Hulten, which is an ecotype growing in standing water and characterized by silvery-tomentose herbage. Another ecotype var. *foliosa* (Nutt) Maguire is less densely hairy and favors drier habitats (Cronquist et al., 1994). In our study area Chamisso arnica is associated with *Carex utriculata, Carex nebrascensis, Artemisia cana*/Mesic graminoid, Warm willow/Gravel bar, Cold willow/Mesic graminoid, *Populus tremuloides*/Mesic graminoid and *Pinus contorta ssp. murrayana/Salix spp.* ecological types. In most places its palatability is low. The *incana* variety has certain physiological adaptations evidently to allow it to grow in standing water. When growing partly submerged, the lower part of the stem becomes free of hairs and both the underground rootstock and the lower part of the stem become hollow inside, perhaps to admit air to the submerged parts (USDA, 1937)

Arnica chamissonis Less. ssp. ***foliosa*** (Nutt.) Maguire - Chamisso arnica

Illustration by John H. Rumely reprinted with permission from *Intermountain Flora Vascular Plants of the Intermountain West, U.S.A.* vol. 5, A. Cronquist et al., copyright 1994, The New York Botanical Garden.



F-42

Aster occidentalis (Nutt.) Torrey & A. Gray - Western aster

Asteraceae (aka. *Aster spathulatus*)

Perennial from a creeping rhizome or sometimes from a mere caudex, mostly 1-5dm tall, stems erect or basally curved, mostly arising singly or few together. Leaves mostly glabrous, entire, progressively reduced in size ascending the stem. Flower heads 3-10 in an open inflorescence. Each flower head 5-7mm long; ray flowers blue or violet to purplish 6-15mm long, disk flowers 8-15mm.

Mostly in wet meadows or along streambanks at elevations below 3000m (Cronquist et al., 1994). In the eastern Sierra this species is common in almost all riparian ecological types. Good reproducers, becoming abundant on overgrazed ranges (USDA, 1937).

Illustration by John H. Rumely reprinted with permission from *Intermountain Flora Vascular Plants of the Intermountain West, U.S.A.* vol. 5, A. Cronquist et al., copyright 1994, The New York Botanical Garden.

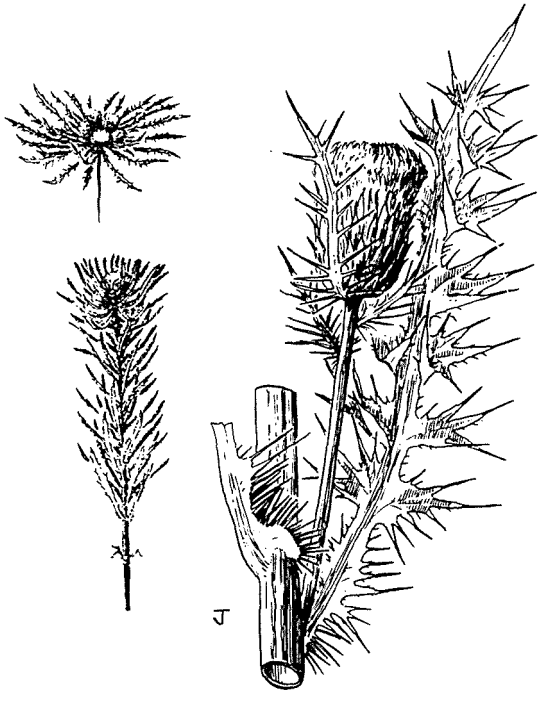
Cirsium scariosum Nutt . - Elk thistle

Asteraceae (*C. drummondii* Torrey & A. Gray and *C. foliosum* (Hook) DC misapplied; *C. tioganum* Congdon)

Biennial or short-lived perennial 0.5-10dm tall. Stems often lacking or very short, sometimes erect, often fleshy, ridged, glabrous to loosely tomentose. Leaves often basal only, glabrous to loosely tomentose; lower 1-4dm, tapered or spiney-petioled, oblong to oblanceolate, subentire to deeply lobed. Inflorescence heads generally sessile in basal leaf rosettes or in clusters at stem tips. Flowers white to purple. Extremely variable, needing study, dwarf and tall plants sometimes occur together.

Moist places and meadows below 3400m. (Hickman, 1993). Meadows and other moist places, from foothills and some of the moister valleys, up to nearly 3200m. in the mountains (Cronquist et al., 1994). Commonly found in Mesic graminoid, *Poa cusickii ssp.epilis, Artemisia cana*/Mesic graminoid, and *Populus tremuloides*/Tall forb ecological types.

Illustration by Jeanne R. Janish reprinted with permission from *Illustrated Flora of the Pacific States*, vol. 4, L. Abrams and R. Ferris., 1960, copyright, The Board of Trustees of the Leland Stanford Junior University.



F-44

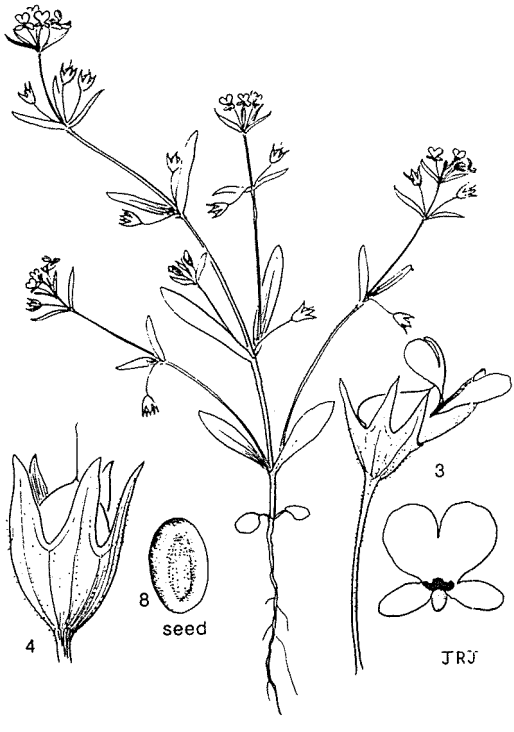
Collinsia parviflora Lindley - Blue-eyed Mary

Scrophulariaceae

Single stemmed herb 3-40cm tall with linear-lanceolate leaves often with margins rolled under. The inflorescence is open and leafy. Calyx 2/3 the length of the corolla; corolla 4-8mm, tube and throat white, upper lip whitish or blue-tipped, main lobes generally blue.

Common in moist, and more or less shady places in mountains below 3500m. (Hickman, 1993). Frequently encountered in *Carex utriculata*, Dry graminoid and *Artemisia cana*/Mesic graminoid ecological types.

Illustration by Jeanne R. Janish reprinted with permission from *Intermountain Flora Vascular Plants of the Intermountain West, U.S.A.* vol. 4, A. Cronquist et al., copyright 1984, The New York Botanical Garden.



Dugaldia hoopesii (A. Gray) Rydb. - Tall Mountain sneezeweed

Asteraceae (*Helenium hoopesii* A. Gray)

Glabrous to densely hairy perennial. Stems erect, 3-9dm. Leaves are entire and alternate, obtuse to acute, basal and lower cauline leaves tend toward oblong, upper cauline tend toward linear. Lower leaves are wing-petioled the upper sessile; blades are three veined. Inflorescence heads are large and radiate; more or less flat topped cymes have 2-15 heads. Disks 19-26mm in diameter; phyllaries in two series. Ray flowers 14-26, yellow to orange 1.5-3.5cm. with tridentate tips. Disk flower corollas 4-5.5mm. Fruit 3.5-4.5mm, pappus 3-4mm. Flowering June through August.

Found in meadows between 1500 and 3000m (Hickman, 1993). Meadows, streamsides, moist open slopes, and open woods in the mountains, 1800-3500m. (Cronquist et al., 1994). In the eastern Sierra this species was found in *Carex scopulorum*, *Poa cusickii ssp. epilis*, *Artemisia cana*/Mesic graminoid and *Pinus contorta ssp. murrayana/Salix spp.* ecological types.

Dugaldia hoopesii (A. Gray) Rydb. - Tall Mountain sneezeweed

Illustration by Robin Jess reprinted with permission from *Intermountain Flora Vascular Plants of the Intermountain West, U.S.A.* vol. 5, A. Cronquist et al., copyright 1994, The New York Botanical Garden.

Epilobium ciliatum (Raf.) - Fringed willow-herb

Onagraceae

Loosely clumped perennial less than 19dm tall. Leaves 1-15cm long, narrowly lanceolate to ovate; veins conspicuous; petiole 0-8mm long. Inflorescence hairy and generally glandular. Sepals 2-7.5mm; petals 2-14mm, white to rose-purple. Fruit 15-100mm, hairy; pedicles 0-30mm.

Abundant in disturbed places and moist meadows, streambanks and roadsides below 4100m (Hickman, 1993). In the eastern Sierra, *Epilobium ciliatum* was found in all but the driest meadows and in aspen stands.

Illustration by Bobbi Angell reprinted with permission from *Intermountain Flora Vascular Plants of the Intermountain West, U.S.A.* vol. 3, Part A., A. Cronquist et al., copyright 1997, The New York Botanical Garden.

F-48

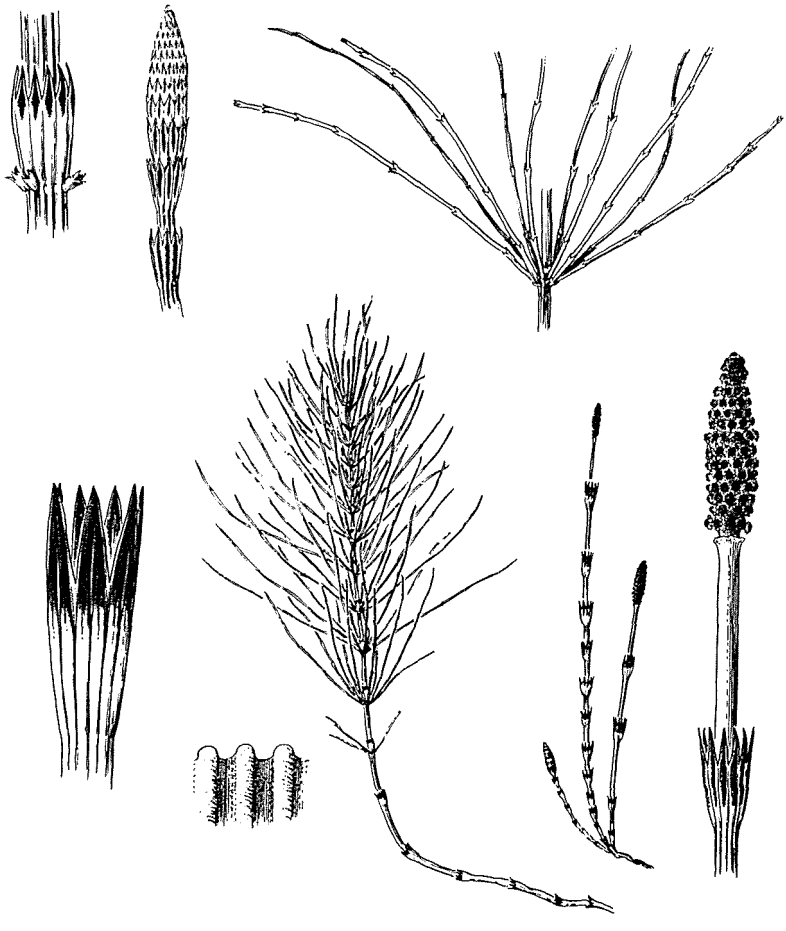
Equisetum arvense L. - Common horsetail

Equisetaceae

Annual with two kinds of stems. The fertile unbranched 11-32cm tall, brown, the sterile branched into a bottlebrush shape 10-60cm, green.

Moist disturbed places below 3000m (Hickman, 1993). Common in the Mesic graminoid, Warm willow/Floodplain, Warm willow/Gravel bar, Cold willow/Mesic graminoid, *Populus tremuloides*/Mesic graminoid ecological types.

Illustration by Jeanne R. Janish reprinted with permission from *Intermountain Flora Vascular Plants of the Intermountain West, U.S.A.* vol. 1, A. Cronquist et al., copyright 1986, The New York Botanical Garden.



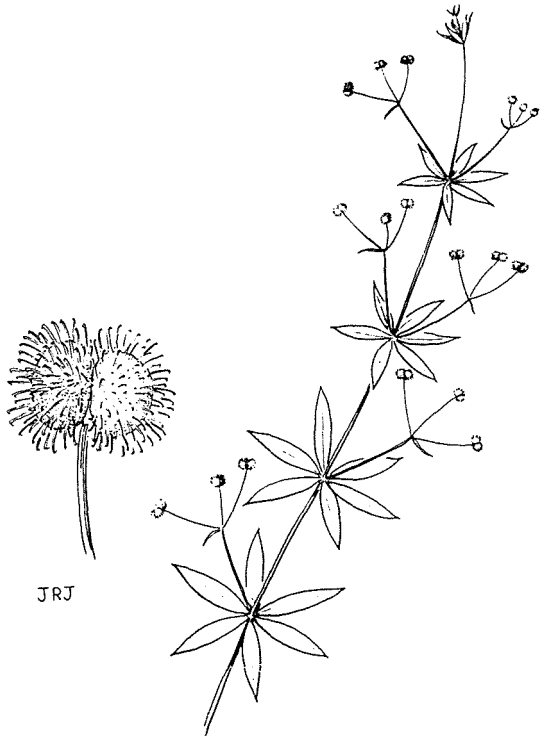
Galium spp. - Bedstraw

Rubiaceae (aka. cleavers)

Ours annuals (or perennials (*G. triflorum*)) with creeping stems. Stems 4-angled when young, leaves in whorls of 2 or more including leaflike stipules. Inflorescence a panicle or axillary cluster of 1 to many inconspicuous flowers. Fruits 2 nutlets, often with hooked hairs. The most common species in eastern Sierran riparian areas are: *G. bifolium*, *G. trifidum*, *G. divaricatum* and *G. triflorum*

Found in the *Carex utriculata*, *Carex nebrascensis, Carex scopulorum*, Cold willow/Mesic graminoid, *Populus tremuloides*/Mesic graminoid, and *Populus tremuloides*/Tall forb ecological types.

Illustration of *Galium triflorum* by Jeanne R. Janish reprinted with permission from *Intermountain Flora Vascular Plants of the Intermountain West, U.S.A.* vol. 4, A. Cronquist et al., copyright 1984, The New York Botanical Garden.



F-50

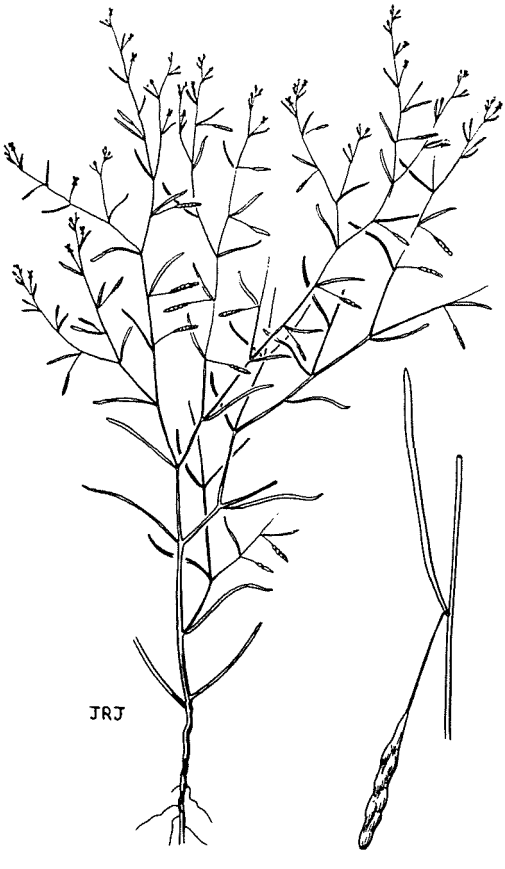
Gayophytum ramosissimum Torrey & A. Gray - Many-flowered smokeweed

Onagraceae

Annual with erect branching slender stems less than 50cm tall. Herbage glabrous, basal leaves 1-4cm. Flower petals 0.7-1.5mm, pink or reddish; fruit 3-9mm, generally shorter than the pedicel, cylindric, slightly knobby.

Found in sagebrush scrub 500-3000m (Hickman, 1993). Found in the *Poa cusickii ssp. epilis* and *Artemisia cana*/Mesic graminoid ecological types.

Illustration by Jeanne R. Janish reprinted with permission from *Intermountain Flora Vascular Plants of the Intermountain West, U.S.A.* vol. 3, Part A, A. Cronquist et al., copyright 1997, The New York Botanical Garden.



Geum macrophyllum Willd. - Large-leaved avens

Rosaceae

Tufted perennial between 20 and 100cm. Leaves generally 10-45cm, made up of 4-6 lateral leaflets and a much larger terminal leaflet. The terminal leaflet 8-10cm long, toothed, 3-lobed. Inflorescence 3-10 flowered. Flowers spherical, 10-15mm in diameter, petals 3-7mm, yellow. Fruits are achenes 2.5-3.5mm, with 2.5-5mm long hooked styles, glabrous to glandular.

Found in meadows, and along streambanks below 3300m (Hickman, 1993). In the eastern Sierran riparian areas *Geum* is frequently found in *Carex utriculata, Carex nebrascensis, Carex scopulorum,* Warm willow/Floodplain, *Salix eastwoodiae*, Cold willow/Mesic graminoid, *Pinus contorta ssp. murrayana*/Mesic graminoid and *Populus tremuloides*/Tall forb ecological types.

Illustration by Jeanne R. Janish reprinted with permission from *Intermountain Flora Vascular Plants of the Intermountain West, U.S.A.* vol. 3, Part A, A. Cronquist et al., copyright 1997, The New York Botanical Garden.

F-52

Iris missouriensis Nutt. - Rocky Mountain Iris

Iridaceae (aka. Western blue flag)

Stiff leaved perennial, 2-5dm tall from a thick (20-30mm diameter) rhizome, usually shallowly rooted. Leaves 3-9mm wide, sometimes purplish at the base. Flowers dark blue to whitish with lilac-purple veins, tube less than 12mm long, pedicel very long.

Moist grassy places (Hickman, 1993). Bottomlands or moist situations, in meadows and parks at elevations below 10,000 feet. Also frequently grows on gravelly hillsides which dry out during the summer (USDA, 1937). Marshes, moist meadows, streambanks, shores and aspen woods, often in soils that dry out by summer's end, in high sagebrush valleys and foothills to subalpine elevations (Cronquist et al., 1977b). In our area found in *Carex nebrascensis*, Mesic graminoid, Dry graminoid, *Artemisia cana*/Mesic graminoid, Warm willow/Floodplain, Warm willow/Gravel bar and *Pinus contorta ssp. murrayana/Salix spp.* ecological types. Iris is an indicator of overgrazing when stands are increasing in size. It is a good soil binder but tends to retard the return of more useful species (USDA, 1937).

Illustration by Jeanne R. Janish reprinted with permission from *Intermountain Flora Vascular Plants of the Intermountain West, U.S.A.* vol. 6, A. Cronquist et al., copyright 1977, The New York Botanical Garden.

Lupinus lepidus Douglas - Sierra lupine

Fabaceae (aka. Dwarf lupine)

Hairy, matted perennial less than 6dm high. Leaves generally basal; stipules 3-25 3-25mm; petiole 2-10cm; leaflets 5-8, 5-40mm long. Inflorescence dense, less than 30cm long. Flowers 6-11mm, petals pink, violet, or blue, banner patch varies in color with variety. Riparian varieties are *L. l. var. confertus, L.l. var. lobbii, L.l. var. sellulus.*

In the eastern Sierra *Lupinus lepidus* is found frequently on the following ecological types: Dry graminoid, *Artemisia cana*/Mesic graminoid, Warm willow/Gravel bar and *Pinus contorta ssp. murrayana*/Mesic graminoid.

Illustration of *L. lepidus var. lobbii* by Jeanne R. Janish reprinted with permission from *Intermountain Flora Vascular Plants of the Intermountain West, U.S.A.* vol. 3, Part B, A. Cronquist et al., copyright 1989, The New York Botanical Garden.

F-54

Montia chamissoi (Sprengel) E. Greene - Miner's lettuce

Portulacaceae (aka. Toad lily

Perennial, 2-30cm, from leafy stolons, erect or prostrate or floating, often tufted or matted; rhizomes scaly, with pink, overwintering bulblets. Leaves opposites, 5-50mm, oblanceolate. Flowers 2-8 in axillary as well as terminal inflorescences. Petals 5-9mm, equal, pink or white. Fruit 1-1.5mm.

Found in wet, sandy or loamy soil around seeps, and in wet meadows (Hickman, 1993). In the eastern Sierra this species was commonly found in *Carex nebrascensis, Carex scopulorum,* Mesic graminoid, *Artemisia cana*/Mesic graminoid, and Cold willow/Mesic graminoid ecological types.

Illustration by Sarah Young reprinted from *The Jepson Manual*, J. Hickman, Ed., 1993, with permission from the Jepson Herbarium., copyright Regents of the University of California.

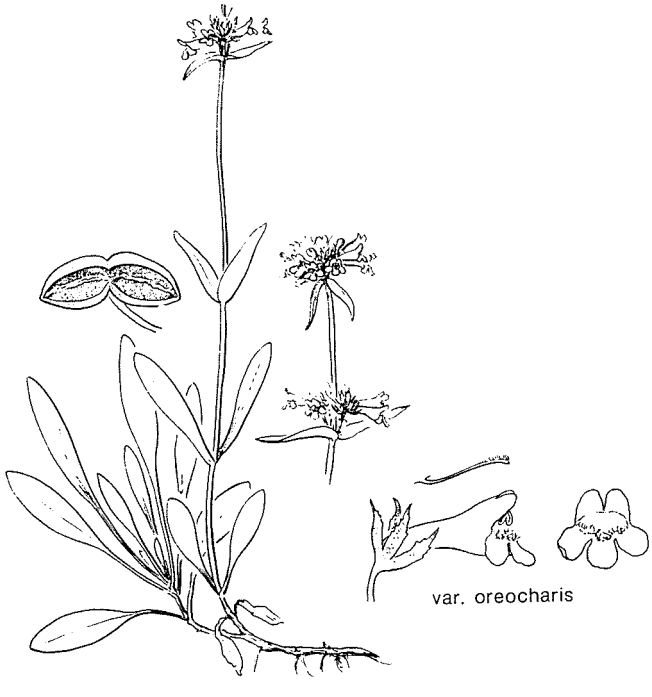
Penstemon rydbergii Nelson var. ***oreocharis*** (E. Greene) N. Holmgren - Rydberg's meadow penstemon

Scrophulariaceae

Perennial from spreading rootstocks, 2-6dm tall. Leaves opposite, entire; stem leaves sessile to clasping; basal leaves drawn into pedicels. Flowers crowded in a terminal spike, pale blue to purple, often with several shades on one plant. Each floral tube 9-14mm.

Moist meadows, streambanks, generally in montane to subalpine forests 1200-3100m (Hickman, 1993). Common and often locally abundant, chiefly in the grass-forb, sagebrush and aspen types (USDA, 1937). Moderately moist to dry slopes, meadows and streambanks from valleys to subalpine and alpine situations 1300-3300m (Cronquist et al., 1984). Found frequently in the *Carex nebrascensis*, Mesic graminoid, *Poa cusickii ssp. epilis*, Dry graminoid, *Artemisia cana*/Mesic graminoid, *Pinus contorta ssp. murrayana*/Mesic graminoid ecological types. Fairly palatable for sheep and cattle. Able to withstand considerable trampling, therefore an indicator of overgrazed ranges (USDA, 1937).

Illustration by Jeanne R. Janish reprinted with permission from *Intermountain Flora Vascular Plants of the Intermountain West, U.S.A.* vol. 4, A. Cronquist et al., copyright 1984, The New York Botanical Garden.



F-56

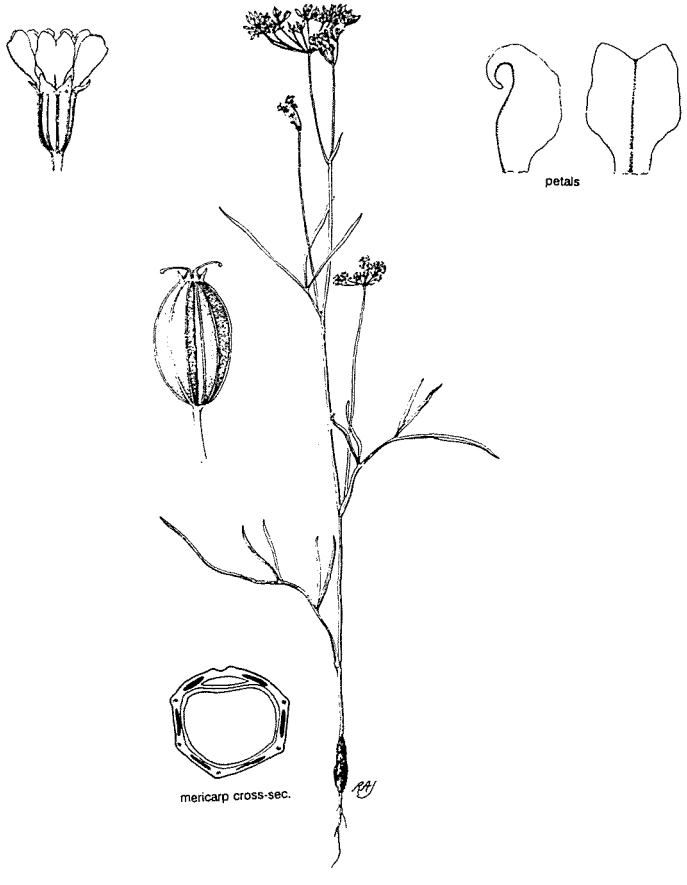
Perideridia lemmoni (J. Coulter & Rose) Chuang & Constance - Lemmon's yampah

Apiaceae

Plants 2.5-9cm tall from single tuberous root. The basal leaf petiole 4-15cm with the basal blade 10-30cm. Basal leaves once or twice ternate or (once or twice pinnate with 1-3 pairs of primary leaflets). Primary leaflets 3-10cm long, linear-lanceolate. Cauline leaves are simple to ternate. Flowers white in an open umbel. Grows with similar *P. parishii,* forming masses of "Queen Anne's lace" in late summer".

Open meadows, coniferous forest edges 1000 - 2500m (Hickman, 1993). Found frequently in *Poa cusickii ssp. epilis* and *Artemisia cana*/Mesic graminoid ecological types.

Illustration by Robin A. Jess reprinted with permission from *Intermountain Flora Vascular Plants of the Intermountain West, U.S.A.* vol. 3, Part A, A. Cronquist et al., copyright 1997, The New York Botanical Garden.



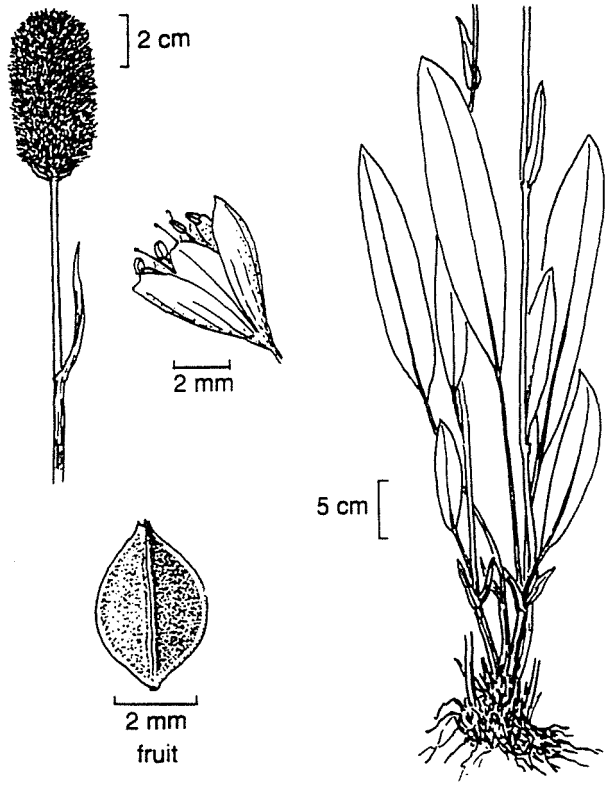
Polygonum bistortoides Pursh - Mountain bistort

Polygonaceae (aka. Western bistort)

Showy perennial from a short, bulb-like rhizome 20-70cm tall. Leaves more or less all basal 15-40cm, petioled, oblong to lanceolate, leathery. Scarious or membranous stipules, sheathing the stem above nodes. Dense, oblong flower head on long peduncle. Flowers white or pink, perianth 4-5mm, stamens exerted.

Common in wet mountain meadows 1500-3000m (Hickman, 1993). Found in *Carex utriculata, Carex nebrascensis, Carex scopulorum*, Mesic graminoid, *Poa cusickii ssp. epilis, Salix eastwoodiae,* Cold willow/Mesic graminoid, *Populus tremuloides*/Mesic graminoid ecological types.

Illustration by Emily E. Reid reprinted from *The Jepson Manual*, J. Hickman, Ed., 1993, with permission from the Jepson Herbarium., copyright Regents of the University of California.



F-58

Polygonum douglasii E. Greene - Douglas' knotweed

Polygonaceae

Erect slender annual, 3-80cm. Alternate, cauline leaves with fused membranous stipules sheathing the stem above nodes. Leaves less than 8cm, sessile, linear to oblanceolate. Inflorescences 5-20cm, open or dense. Flowers pink or white, margins and midribs or perianth generally red or green. Variable intergrading complex of subspecies.

Common on open, slopes and dry meadows below 3500m (Hickman, 1993). Encountered frequently in *Carex nebrascensis, Carex scopulorum,* Mesic graminoid, *Poa cusickii ssp. epilis,* Dry graminoid, *Pinus contorta ssp. murrayana*/Mesic graminoid ecological types.

Illustration of *P. douglasii ssp. douglasii* by Emily E. Reid reprinted from *The Jepson Manual*, J. Hickman, Ed., 1993, with permission from the Jepson Herbarium., copyright Regents of the University of California.

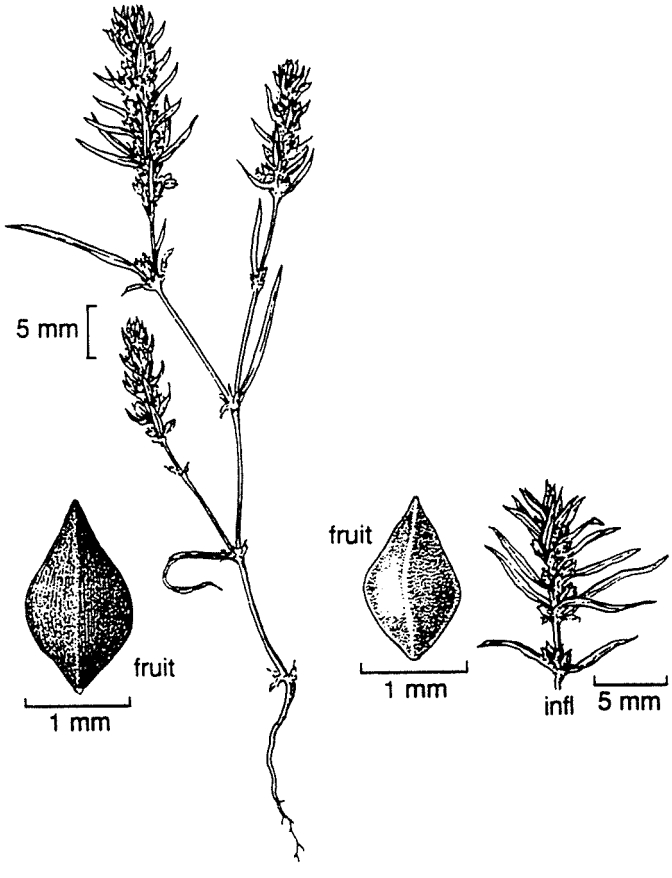
Polygonum polygaloides Meissner - Kellogg's knotweed

Polygonaceae

Slender stemmed annual 1-15 (30)cm tall. Leaves less than 4cm long, sessile, joint with stipule is obvious; lower leaves are linear to lanceolate. Inflorescence is crowded at the stem tips 3-15mm, 5-15mm wide (or somewhat larger). Floral perianth 1.5mm. white to red. Most of ours are *P. p.* ssp. *kelloggii* although the subspecies intergrade somewhat.

Common in vernally moist places, mountain meadows, seeps and rainpools 1500-3000m (Hickman, 1993). Found most commonly in the following ecological types: *Poa cusickii ssp. epilis*, Dry graminoid and *Artemisia cana*/Mesic graminoid.

Illustration of *P. polygaloides* by Emily E. Reid reprinted from *The Jepson Manual*, J. Hickman, Ed., 1993, with permission from the Jepson Herbarium., copyright Regents of the University of California.



F-60

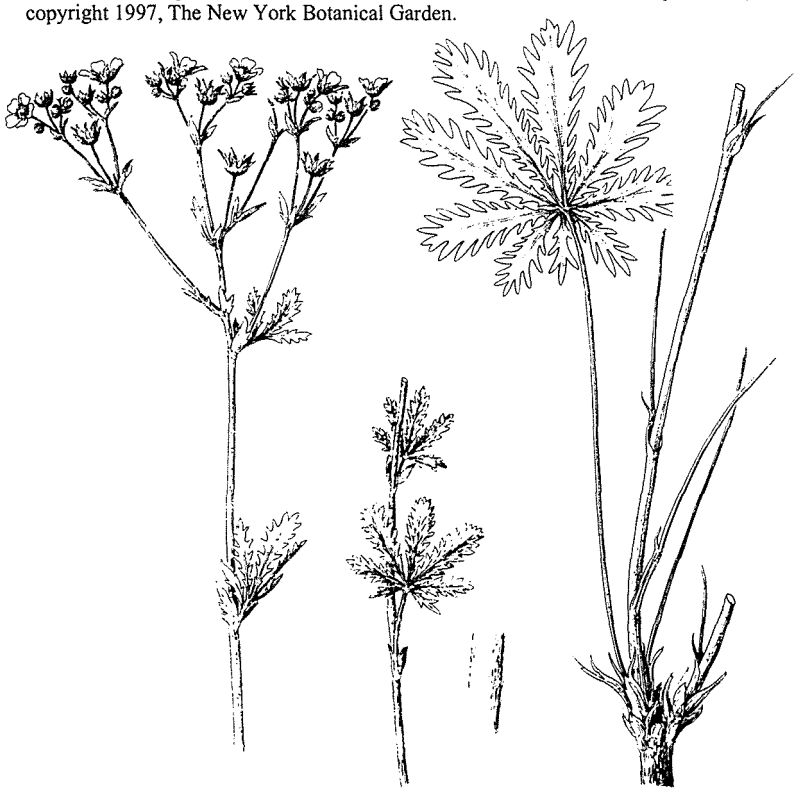
Potentilla gracilis var. ***fastigiata*** (Nutt.) S. Watson - Northwest cinquefoil

Rosaceae (aka. *Potentilla gracilis ssp. nuttallii* (Lehm.) Keck, *P.g. var. glabrata* (Lehm.) C. Hitchcock, *P.g. var. mollis* (Rydb.) C. Hitchc.)

Tufted perennial arising from short, thick rhizomes, 2-5dm tall; Leaves palmate, the basal leaves largest 20-60mm. with 5-7 leaflets, hairy, above and below; hairs spreading to appressed. Inflorescence an open cyme. Flowers yellow, petals 4-7mm.

Common in open forests, and dry meadows from 800-3500m. (Hickman, 1993). Grows abundantly in rich, porous loams of meadows and open parks. It appears sparsely on dry, sandy, gravelly, or clay loams or mountain slopes, among sagebrush, in open aspen and Douglas fir, as well as along moist canyon bottoms from 4,500 to 9,000ft. (USDA, 1937). In the eastern Sierra, cinquefoil is frequently found in all ecological types **except** Aspen and Warm willow/Gravel bar. The leaves are generally grazed but lightly because of the bitter tannic acid which accumulates in the foliage. Cinquefoil is a very aggressive plant; it withstands heavy trampling and invades ranges readily when more palatable and less resistant species are lost. An indicator of overgrazing. The cinquefoils set numerous seed which generally is quite viable. (USDA, 1937).

Illustration by Jeanne R. Janish reprinted with permission from *Intermountain Flora Vascular Plants of the Intermountain West, U.S.A.* vol. 3, Part A, A. Cronquist et al., copyright 1997, The New York Botanical Garden.



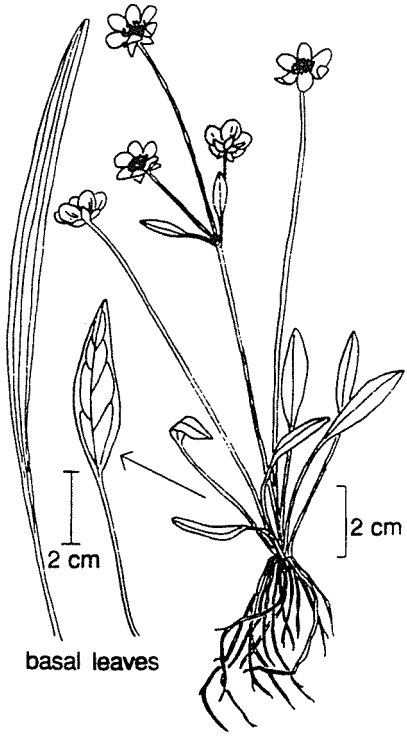
Ranunculus alismifolius Benth. - Water plantain buttercup

Ranunculaceae

A perennial 4-50cm tall from thick, fleshy roots. Stems generally branched from the base, decumbent to erect. Lower leaves with 2-7cm long petioles, oblong to ovate, upper leaves linear to lanceolate. Flowers in an open cyme, petals yellow 5-15mm long, 2-5.5mm wide. Fruits 12-many in spheric clusters. The individual fruits 1.5-2.5mm, smooth to sparsely puberulent, back rounded, with a 0.5-1mm long straight beak.

Found in wet places, streambanks, meadows, and coniferous forest (Hickman, 1993). Frequently found in *Carex nebrascensis, Carex scopulorum* and *Poa cusickii ssp. epilis* riparian ecological types of the eastern Sierra.

Illustration of *R. alismifolius var. alismifolius* by Sarah Young reprinted from the *Jepson Manual*, J. Hickman, Ed., 1993, with permission from the Jepson Herbarium, copyright Regents of the University of California.



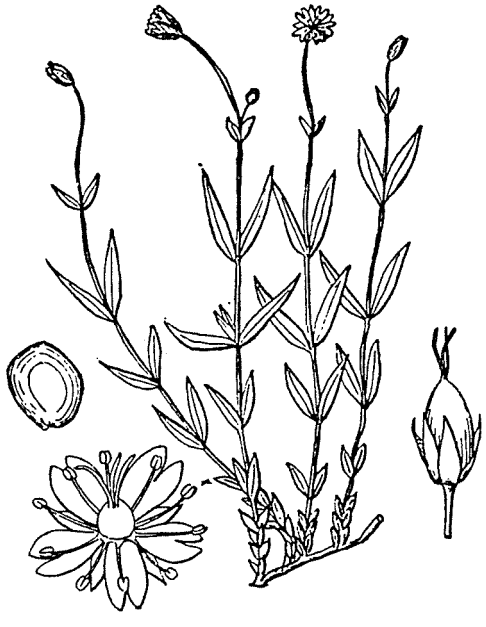
Stellaria longipes var. longipes Goldie - Longstalk starwort

Caryophyllaceae (aka. *Alsine longipes* Goldie)

Ascending to erect perennial 5-35cm fall from white rhizomes. Leaves evenly placed, 10-40cm long, linear to linear-lanceolate, flat, shiny sometimes ciliate near base. Inflorescence terminal or axillary, 1-7 flowered. Flowers white on pedicles with leafy bracts below.

Streambanks, moist to boggy meadows, seeps 1250-3500m (Hickman, 1993). Commonly found in *Carex utriculata, Carex nebrascensis, Carex scopulorum*, Mesic graminoid, *Poa cusickii ssp. epilis*, Warm willow/Floodplain, *Salix eastwoodiae*, Cold willow/Mesic graminoid, and *Pinus contorta ssp. murrayana*/Mesic graminoid ecological types in the eastern Sierra. An indicator of moderate to high ecological status.

Illustration by Jeanne R. Janish reprinted with permission from the *Illustrated Flora of the Pacific States*, vol 2, L. Abrams, 1944 copyright Board of Regents of the Leland Stanford Junior University..



F-64

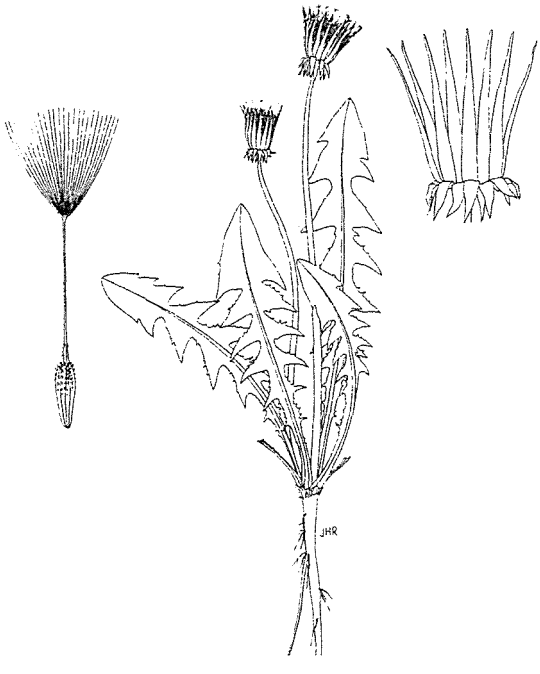
Taraxacum officinale Wigg. - Common dandelion

Asteraceae (aka. *Leontodon officinale* L., *T. laevigatum* (Willd.) D.C.)

Perennial with basal leaves, from a taproot, and milky sap. Leaves variously toothed and lobed. Stems smooth and hollow. Flower heads 2-3.3 cm in diameter; outer phyllaries reflexed, 5-8mm. Flowers many, ligules yellow, readily withering. Fruit with pappus of many, white , slender bristles, not plumose.

Abundant weed of lawns and meadows below 3300m (Hickman, 1993). Prefers moist soils or at least those that remain moist until midsummer. Weedy meadows, along open stream banks and to a lesser degree on moist, open slopes in stands of aspen and lodgepole pine. A typical location for dandelion is gully-drained soils of eroded meadows (USDA, 1937). In the eastern Sierra, dandelion was frequently found in all riparian ecological types except *Poa cusickii ssp. epilis, Pinus contorta ssp. murrayana/Salix ssp.*, and *Populus tremuloides*/Tall forb ecological types. Readily eaten by range livestock. Under intensive grazing and denuded soil conditions, dandelion plants usually cling to the ground. Able to withstand trampling and heavy grazing because of deep taproot. Its presence alone is not necessarily an indication of overgrazing. It occurs frequently in protected pastures as well as in areas where normal plant cover is depleted (USDA, 1937).

Illustration by John H. Rumely reprinted with permission from *Intermountain Flora Vascular Plants of the Intermountain West, U.S.A.* vol. 5, A. Cronquist et al., copyright 1994, The New York Botanical Garden.



Trifolium longipes Nutt. - longstalk clover

Fabaceae

Spreading or erect perennial, leaves both basal and along the stem. Leaves palmately compound in threes. Leaflets 2-5cm long. Stipules at base of petioles oblong lanceolate to ovate. Inflorescence head-like 1.5-3cm wide, peduncle often bent or curved at tip. Calyx 5-10mm, lobes lanceolate to bristle-like, generally longer than the tube. Corolla 10-18mm, dull white, purple or bi-colored.

Meadows, streambanks, forest, open slopes, 600-3000m (Hickman, 1993). Found frequently in *Carex nebrascensis, Carex scopulorum*, Mesic graminoid, *Poa cusickii ssp. epilis*, *Artemisia cana*/Mesic graminoid, Warm willow/Floodplain, *Salix eastwoodiae*, Cold willow/Mesic graminoid, and *Pinus contorta ssp. murrayana*/Mesic graminoid ecological types of the eastern Sierra. Very palatable for herbivores, though some diseases are associated with clover and its associated fungi. Clovers can increase soil fertility by fixing nitrogen from the air and through the mechanical action of their long, deep root systems (USDA, 1937).

Illustration by Bobbi Angell reprinted with permission from *Intermountain Flora Vascular Plants of the Intermountain West, U.S.A.* vol. 3, Part B, A. Cronquist et al., copyright 1989, The New York Botanical Garden.

F-66

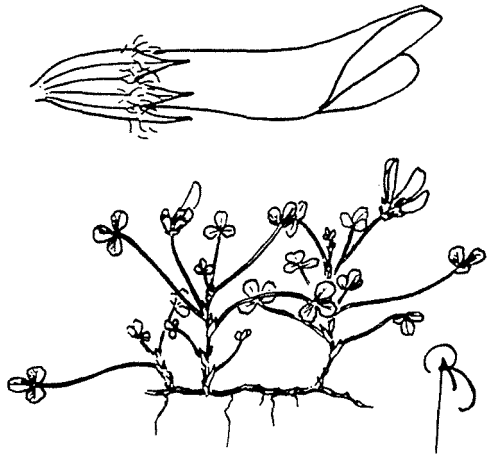
Trifolium monanthum A. Grey - Mountain carpet clover

Fabaceae

Very small, often cespitose perennial with slender or reduced stems. Leaves are generally basal with lanceolate to ovate, stipules. Leaflets are 2-12mm long, elliptic-oblanceolate to widely obovate. The inflorescence is a reduced head with 1-6 flowers. The calyx 4-5mm with lobes as long as tube and bristle tipped. Corolla 7-12mm, white or with lavender stripes.

Pinyon-juniper belt upward, mountan forests near streams, wet meadows with aspen or willows, coniferous woodlands 1500-3800m (Hickman, 1993). Found frequently in the *Carex scopulorum*, Dry graminoid, *Salix eastwoodiae* and Cold willow/Mesic graminoid riparian ecological types of the eastern Sierra.

Illustration by Bobbi Angell reprinted with permission from *Intermountain Flora Vascular Plants of the Intermountain West, U.S.A.* vol. 3, Part B, A. Cronquist et al., copyright 1989, The New York Botanical Garden.



Trifolium wormskjoldii Lehm. - Cows clover

Fabaceae

Decumbent or ascending perennial. Leaves generally basal lower stipules bristle-tipped, upper stipules wide, toothed or sharply lobed. Leaflets 1-3cm long, narrowly elliptic to widely ovate. Inflorescence head-like, 2-3cm wide, involucre wheel-like, segment or lobes many. Calyx 7-11mm, lobes tapered; corolla 12-16mm pink-purple, or magenta, tip white.

Beaches to mountain meadows, ridges, generally open moist, or marshy places below 3200m (Hickman, 1993). In the eastern Sierra, cows clover was frequently sampled in *Carex nebrascensis, Carex scopulorum*, Mesic graminoid, Warm willow/Floodplain, Warm willow/Gravel bar, *Salix eastwoodiae*, and *Populus tremuloides*/Mesic graminoid ecological types.

Illustration by Jeanne R. Janish reprinted with permission from *Intermountain Flora Vascular Plants of the Intermountain West, U.S.A.* vol. 3, Part B, A. Cronquist et al., copyright 1989, The New York Botanical Garden.

F-68

Veronica spp. - Speedwell

Scrophulariaceae (aka. Brooklime)

Ours mostly of species *americana*. Aquatic, rhizomatous perennial 0.5-3.5dm tall. Stems erect, but somewhat curved at the base and rooting from lower nodes. Herbage glabrous, leaves petiolate, the blades 1.5-3cm long and 7-20mm wide. Inflorescences are axillary racemes, 10-25 flowered. The blue corollas are 5-10mm across. Fruit a capsule 2.5-3.8mm long, 3-4mm broad.

Common in moist, muddy or inundated soils of springs, slow-flowing streams, lake shores or meadows. 1400 to 3300m (Cronquist et al., 1984). Found frequently in wet habitats of *Carex utriculata, Carex nebrascensis* and *Populus tremuloides*/Tall forb ecological types.

Illustration by Jeanne R. Janish reprinted with permission from *Intermountain Flora Vascular Plants of the Intermountain West, U.S.A.* vol. 4, A. Cronquist et al., copyright 1984, The New York Botanical Garden..

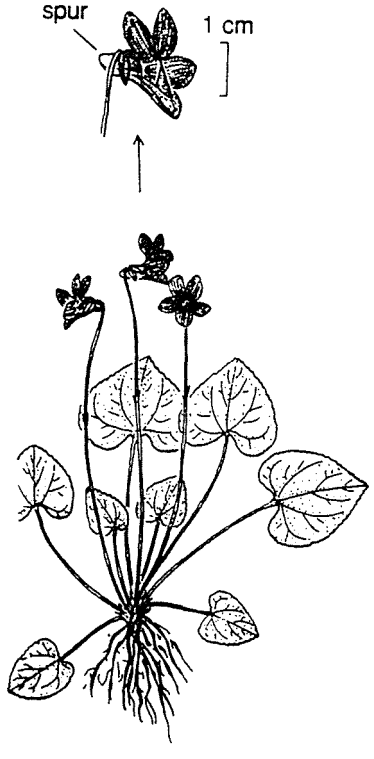
Viola sororia Willd. ssp. ***affinis*** (LeConte) R.J. Little - Sand violet

Violaceae (aka. *V. nephrophylla*, LeConte's violet)

Plants 3-25cm from short thick rhizomes with long fibrous roots. Basal leaves with petioles 50-230mm long; blades ovate to reniform, toothed, 10-45mm. Flower peduncle the same length as leaf petioles, flower petals deep blue-violet, 10-19mm, white bearded. Fruit 5-10mm, glabrous.

Shady, moist ground below 2300m (Hickman, 1993). Found frequently in *Carex utriculata, Pinus contorta ssp. murrayana*/Mesic graminoid and *Populus tremuloides*/Tall forb riparian ecological types of the eastern Sierra. This species is a specific host for the larve of the Apache silverspot butterfly.

Illustration of *V. sororia ssp. affinis* by Linda Ann Vorobik reprinted from the *Jepson Manual*, J. Hickman, Ed., 1993, with permission from the Jepson Herbarium, copyright Regents of the University of California



F-70

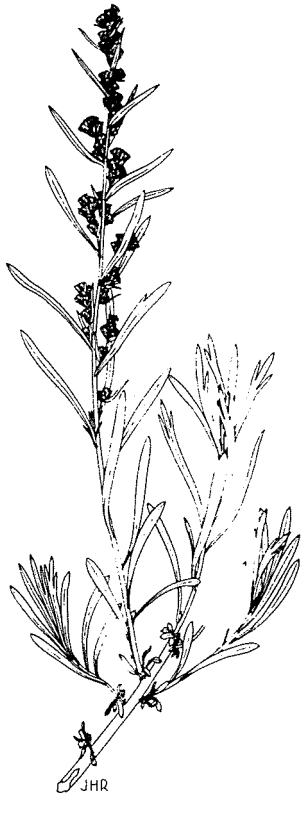
Artemisia cana Pursh ssp. ***bolanderi*** (A. Gray) G. Ward- Silver sagebrush

Asteraceae (aka. *A. tridentata ssp. bolanderi* -A. Gray))

Low shrub (less than 9dm) from a woody trunk, with white felty stems. Leaves are linear to narrowly lanceolate, generally entire; winter deciduous. Inflorescence 12-20cm long, leafy; heads generally sessile 2-3 per cluster. Ours may be more closely aligned with *A. cana ssp. viscidula*

Gravelly soils, meadows, streambanks 1600-3300m (Hickman, 1937). Growing at elevations above 5500ft in areas that have high seasonal water tables. This is the key species of the *Artemisia cana*/Mesic graminoid ecological type but it also frequently occurs in *Carex utriculata*, Mesic graminoid, Dry graminoid, and Warm willow/Gravel bar ecological types

Illustration by John H. Rumely reprinted with permission from *Intermountain Flora Vascular Plants of the Intermountain West, U.S.A.* vol. 5, A. Cronquist et al., copyright 1994, The New York Botanical Garden.



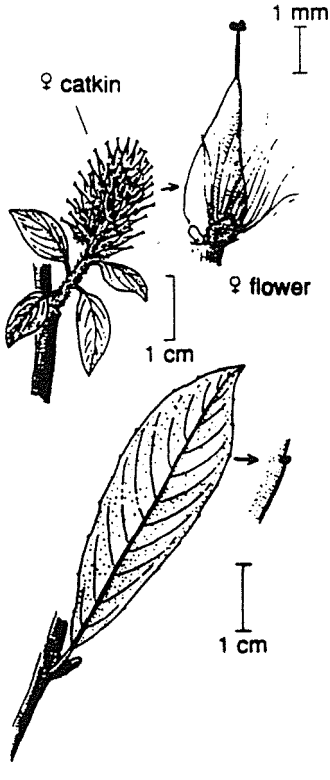
Salix boothii Dorn - Booth's willow

Salicaceae

A many-branched shrub to 3-4.6m in height on well-drained sites (much shorter at high elevations and in bogs); young twigs glabrous to moderately pubescent, glabrous by the second year. Leaves broadly elliptic to lanceolate, firm and thick, green above, paler green below but not glaucous, 2.5-6cm long, 8-22mm wide; margins with fine gland-tipped teeth at least when young; pubescent only when young, quickly glabrate. Flowers: staminate aments 1-2.5cm long, pistillate aments 2-4cm long; floral branchlets 1-3mm long, small-leaved; floral bracts brown to black, long curly hairs. Capsules glabrous.

On a wide variety of moist to wet places such as shrub meadows, streambanks, swamps and bogs; low to high elevations. Highly palatable to livestock, deer, elk and beaver (Kovalchick, et al., 1988). Wet subalpine meadows, shores 1700-3200m (Hickman, 1993). We found this species associated with the *Populus tremuloides*/Tall forb ecological type as well as with the Cold willow/Mesic graminoid ecological type.

Illustration by Linda Ann Vorobik reprinted from the *Jepson Manual*, J. Hickman, Ed., 1993, with permission from the Jepson Herbarium, copyright Regents of the University of California



F-72

Salix eastwoodiae A.A. Heller - Sierra willow

Salicaceae (aka. *S. commutata* Bebb)

Shrub up to 4m high. Young twigs violet to brown, glaucous or not, shaggy-hairy, becoming glabrous with age. Leaves with glandular petioles, lanceolate to widely elliptic or oblanceolate, 27-99mm. Leaf surfaces hairy, becoming glabrous, lower not glaucous. Flowers: Aments 16-45mm on leafy shoots 2-20mm. The margins of the shoot leaves finely serrate or gland dotted. Stamens two. Ovary silky, style 0.6-1.5mm, stalk 0.2-1.6mm.

Alpine and subalpine meadows, streams, talus, 1600-3800m (Hickman, 1993). This is the key species of the *Salix eastwoodiae* ecological type. Often it is found in multispecies stands with *Salix planifolia*, *Salix orestra* and *Salix lemmoni.*

Illustration by W. S. Atkinson reprinted with permission from the *Illustrated Flora of the Pacific States*, vol 1, L. Abrams, 1940 copyright Board of Regents of the Leland Stanford Junior University..

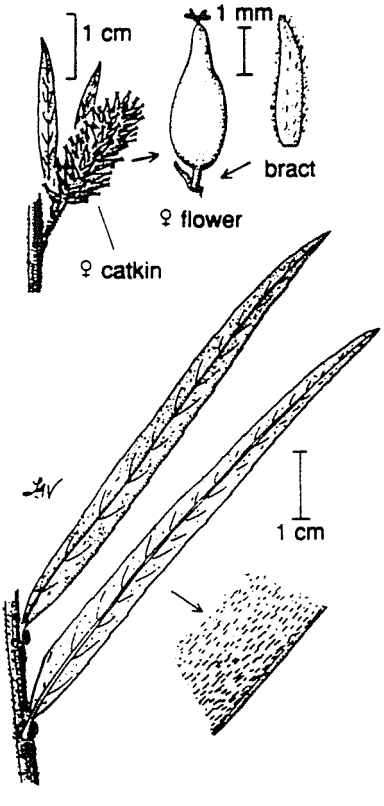
Salix exigua Nutt. - Sandbar willow

Salicaceae

Colonial, spreading shrub 4.6-7.6m tall; twigs of the season thinly to densely pubescent with straight, appressed hairs, glabrous and brownish in the second year. Leaf blades narrowly lance linear, grey-green or silvery with dense white hairs (rarely glabrate), glaucous beneath, entire or few toothed. Flowers: Staminate aments 1.5-4.5cm long. pistillate aments 1.5-6cm long; floral branchlets 1-20cm long, very leafy; floral bracts yellow, villous, deciduous. Fruit sessile, hairy capsules.

Streambanks, ditches and gravel bars; low elevations, generally only in the foothills. Highly palatable to livestock, big game, and beavers (Kovalchick, et al., 1988). Streamsides, marshes, wet ditches below 2700m (Hickman, 1993). Frequently associated with the Warm willow/Floodplain and Warm willow/Gravel bar ecological types.

Illustration by Linda Ann Vorobik reprinted from the *Jepson Manual*, J. Hickman, Ed., 1993, with permission from the Jepson Herbarium, copyright Regents of the University of California



F-74

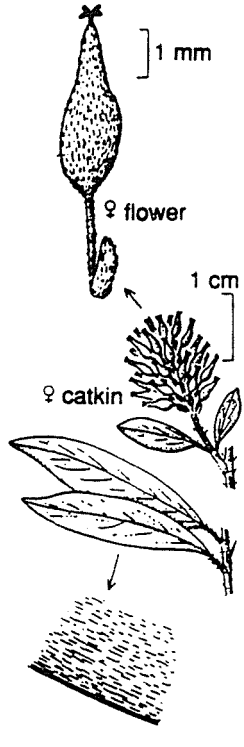
Salix geyeriana Anderson - Geyer's willow

Salicaceae

Many-stemmed shrubs to 4.6m tall; young twigs densely pubescent, becoming strongly glaucous; older twigs glabrate. Leaves narrowly elliptical, entire, 2-4.5cm long, 8-12mm wide, glaucous beneath, densely appressed-hairy on both surfaces when unfolding, becoming sparsely to moderately hairy at maturity. Flowers born on short aments, staminate aments 7-15mm long, pistillate aments 1-2cm long, floral branchlets up to 1cm long, leafy; floral bracts yellow to light brown, short-hairy. Fruit capsules with short hairs.

Moist to wet meadows, marshes and streambanks; widespread, higher elevations. Moderately high palatability for livestock, big game and beaver (Kovalchick et al., 1988). Subalpine streams, meadows 1450-3600m (Hickman, 1993). Inhabiting relatively dry portions of the riparian zone (Brunsfeld and Johnson, 1985). In eastern Sierra riparian settings, Geyer's willow was associated with a wide variety of ecological types: *Carex utriculata, Carex nebrascensis*, Mesic graminoid, Warm willow/Floodplain, Warm willow/Gravelbar, *Salix eastwoodiae*, Cold willow/Mesic graminoid, *Populus tremuloides*/Mesic graminoid, *Pinus contorta ssp. murrayana*/Mesic graminoid, *Pinus contorta ssp. murrayana/Salix spp.* ecological types.

Illustration by Linda Ann Vorobik reprinted from the *Jepson Manual*, J. Hickman, Ed., 1993, with permission from the Jepson Herbarium, copyright Regents of the University of California



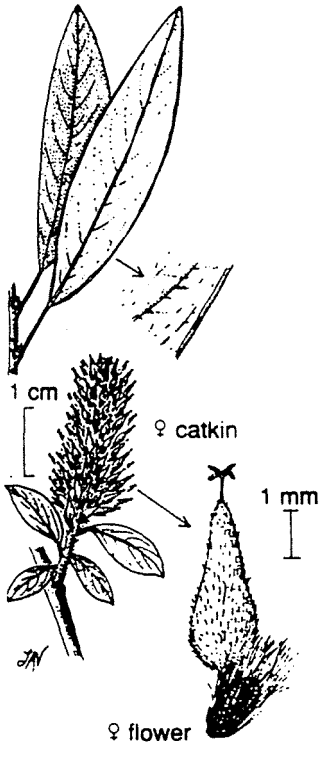
Salix lemmonii Bebb - Lemmon's willow

Salicaceae

Shrub up to 4m tall. Twigs yellowish to brownish, generally thinly glaucous, glabrous and sometimes brittle at the base. Leaves have leaf-like stipules; young leaves silky; mature leaf blades 44-110mm, oblong-lanceolate to elliptic, acuminate, entire or finely serrate, white-and-rusty silky, becoming glabrous, lower surface glaucous. Inflorescence appearing with or just before the leaves in spring. Aments are 13-50mm long, sessile or on leafy shoots less than 6mm long. Floral bracts are tawny to dark brown. Ovary silky hairy, style 0.3-0.8mm on a 1.2-2.1mm stalk.

Streams, wet meadows, burns in subalpine pine forests, 1400-3500m (Hickman, 1993). Found in *Salix eastwoodiae*, Cold willow/Mesic graminoid, *Populus tremuloides*/Mesic graminoid, *Pinus contorta ssp. murrayana*/Mesic graminoid, and *Pinus contorta ssp. murrayana/Salix spp.* ecological types.

Illustration by Linda Ann Vorobik reprinted from the *Jepson Manual*, J. Hickman, Ed., 1993, with permission from the Jepson Herbarium, copyright Regents of the University of California



F-76

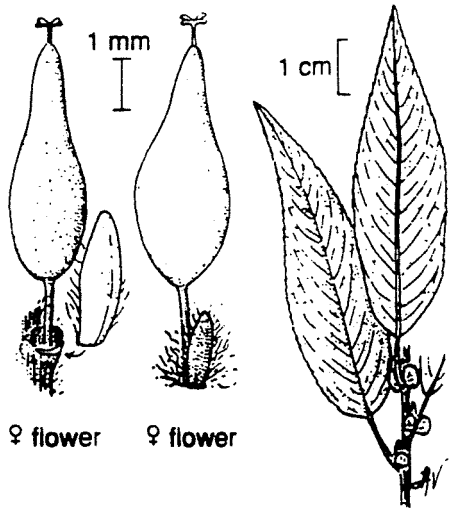
Salix lutea Nutt. - Yellow willow

Salicaceae

Rounded shrubs to 5.5m tall, occasionally a several-stemmed tree with trunks up to 3dm in diameter. Twigs variable, from yellow to reddish-brown or silvery-gray. Leaves variable, lanceolate or elliptical, with a round to cordate base and usually glaucous beneath, 2-5.5cm long, 9-21mm wide. Plants with leaves glabrous beneath have been called *Salix lutea* non-glaucus (Manning and Padgett, 1995) and *Salix lutea x S. boothii* (Weixelman et.al., 1996). Flowers borne on long aments, staminate aments 2-5cm long and about 1cm wide, pistillate aments 2-7cm long and to 2cm wide; leafy floral branchlets; floral bracts brownish, minute glabrous. Fruit a glabrous capsule.

Streambanks and ditches; generally more abundant at lower elevations within the sagebrush/bunchgrass zone, extending to moderate elevations. Moderate to high palatability for livestock, deer, elk and beavers (Kovalchick et al., 1988). Creek margins and wet meadows, 900-3100m (Hickman, 1993). In the eastern Sierra this species was associated with Warm willow/Floodplain, Warm willow/Gravel bar and *Pinus contorta ssp. murrayana*/Mesic graminoid ecological types.

Illustration by Linda Ann Vorobik reprinted from the *Jepson Manual*, J. Hickman, Ed., 1993, with permission from the Jepson Herbarium, copyright Regents of the University of California



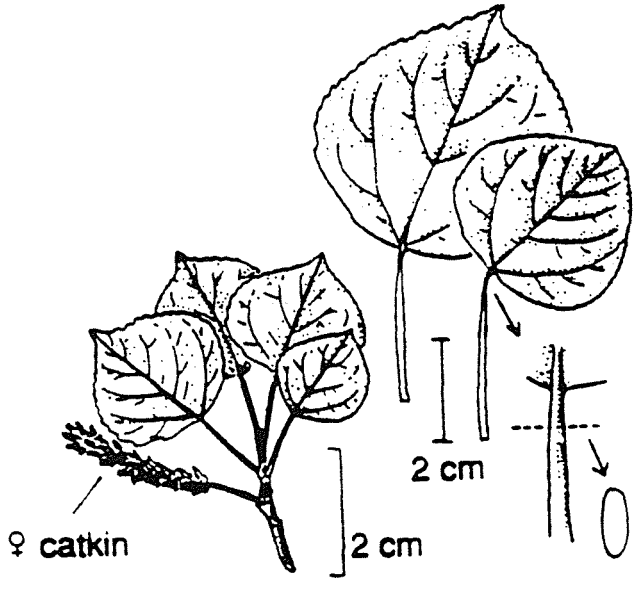
Populus tremuloides Michaux. - Quaking aspen

Salicaceae

Highly clonal tree with narrow crown; trunk less than 15m tall. Twigs greenish-white, glabrous; winter buds shiny. Leaf petioles laterally compressed, 2/3 to equal to the length of the leaf blades. Inflorescence pendent catkins.

Streamsides, moist openings and slopes in montane and subalpine forests, woodlands, sagebrush steppe, 1800-3000m (Hickman, 1993). Along creeks and on meadow edges as well as on open ridges. Riparian aspen types were described from elevations between 6350 and 8700ft in the eastern Sierra. Aspen is the key species for two riparian ecological types in the eastern Sierra. Important wildlife habitat especially for deer fawning , bud eating grouse, dam building beaver, raptors and cavity nesting birds. Soils are deep and fertile if duff is accumulating on site. Several fungus species further decay in aspen groves and cause periodic blites. Groves are clonally reproducing. Reproduction is generally stimulated by some sort of disturbance of the canopy. Some aspen sites are seral to conifers (Lanner, 1983).

Illustration by Linda Ann Vorobik reprinted from the *Jepson Manual*, J. Hickman, Ed., 1993, with permission from the Jepson Herbarium, copyright Regents of the University of California



F-78

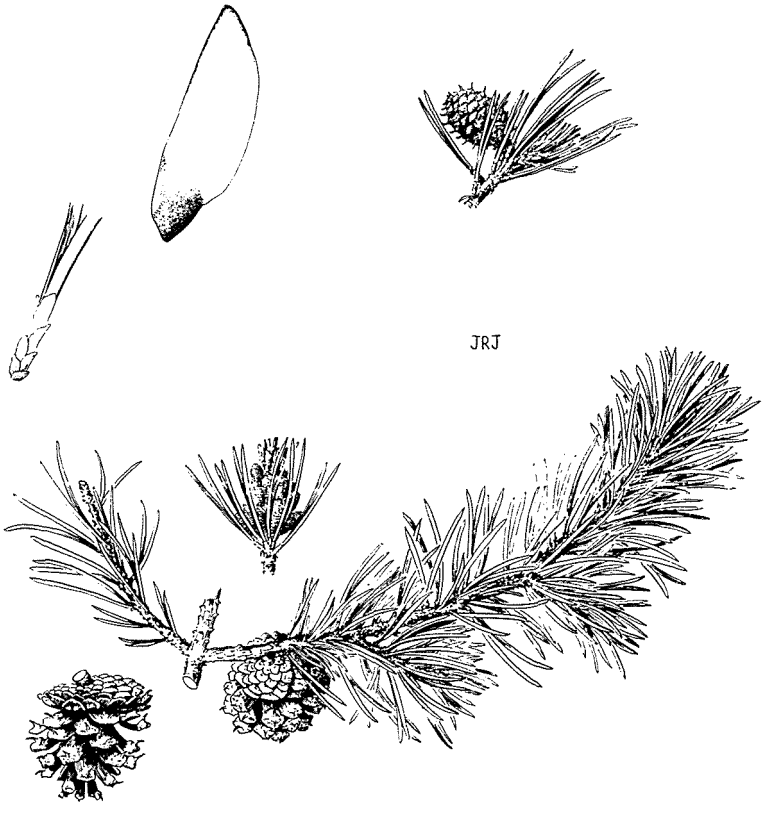
Pinus contorta ssp. murrayana (Grey. & Balf.) Critchf. - Lodgepole pine

Pinaceae (aka. *Pinus murrayana* Grev. & Balf.)

Tree to 34m in height. Mature bark scaly, thin. Leaves 2 per bundle, 2.5-8.6cm, sheath persistent. Seed cone is more or less symmetrical, pendent, less than 5cm long, deciduous after several years.

Found in forest settings as single species stands, mixed with other conifers, in wet meadows, or cold places below 3500m (Hickman, 1993). Lodgepole pine is the key species associated with two riparian ecological types in the eastern Sierra. This species was also associated frequently with the *Populus tremuloides*/Mesic graminoid ecological type.

Illustration by Jeanne R. Janish reprinted with permission from *Intermountain Flora Vascular Plants of the Intermountain West, U.S.A.* vol. 1, A. Cronquist et al.et al., copyright 1986, The New York Botanical Garden.



APPENDIX G. Riparian plant species and their indicator value

Plant species are indicators of their environment. Some species are best used as indicators of ecological type, the landscape setting and potential of a site, while others indicate specific disturbances or the colonization of disturbed areas. In the analysis process associated with development of the eastern Sierra riparian classification and scorecards the indicator value of many species was discerned. In spring of 1998, a group of Forest Service ecologists and rangeland managers with extensive experience in the Sierra Nevada and southern Cascades convened to concur on the apparent indicator value of a large number of riparian species. The following table is the product of both processes.

The five habitats in the table following each refer to a group of ecological types.

Wet meadows include:

Carex scopulorum -- Typic Cryaquoll -- Trough drainageway
Carex utriculata -- Oxyaquic Haplocryoll -- Floodplain
Carex nebrascensis -- Typic Cryaquoll -- Drainageway ecological types.

Moist meadows include:

Mesic Graminoid -- Oxyaquic Haplocryoll -- Drainageway
Poa cusickii ssp. epilis -- Aquic Haplocryoll -- Trough drainageway and Floodplain ecological types.

Dry Meadow encompasses only the

Dry Graminoid -- Typic Haplocryoll -- Trough drainageway ecological type.

Non-Meadow Moist habitats incude:

Artemisia cana/Mesic Graminoid -- Pachic Haplocryoll -- Drainageway
Salix eastwoodiae -- Cryaquoll -- Floodplain
Warm Willow -- Oxyaquic Cryorthent -- Gravel bar
Warm Willow -- Typic Cryaquent -- Floodplain
Cold Willow/Mesic graminoid -- Cryaquoll -- Floodplain
Cold Willow/Mesic forb -- Haplocryoll -- Floodplain
Populus tremuloides/Mesic graminoid -- Haplocryoll -- Floodplain and Stream terrace
Pinus contorta ssp. murrayana/Mesic graminoid -- Haplocryoll -- Stream terrace and Floodplain
Pinus contorta ssp. murrayana/Salix spp. -- Cryaquoll -- Floodplain ecological types.

Non- Meadow Dry habitat encompasses only the:

Populus tremuloides/Tall forb -- Cumulic Haplocryoll -- Trough floodplain ecological type.

Boldface type indicates the occurrence of a species and its indicator value on the Toiyabe National Forest as developed through this classification effort. The standard type indicates the occurrence and indicator value assigned by ecologists in their experience in a larger area. Species scientific taxonomy primarily comes from The Jepson Manual, Higher Plants of California (Hickman, 1993). Codes and common names come from the PLANTS database as of Jan 6, 1994 (Kartez, J. , 1994) as well as the Jepson Manual. The PLANTS database is maintained by the Biota of North America Program and the Natural Resources Conservation Service. Indicator values are as follows: L = indicating low seral conditions or conditions with low similarity to PNC. Disturbance indicators, or early colonizers. M = indicating moderate similarity to PNC. H= High similarity to PNC. X indicates occurrence on Toiyabe plots, no indicator value established. Species composition of course plays a big role in evaluating ecological status of a site. Transects and scorecards are needed to evaluate the relative abundance of these indicator species.

Botanical Name Grasses	Code	Common Name
Achnatherum		
lettermanii	ACLE9	Letterman's needlegrass
nelsonii	STNE3	Nelson's needlegrass
nelsonii var. dorei	ACNED	Columbia needlegrass
nevadensis	ACNE10	Nevada needlegrass
occidentalis ssp.		
californicum	ACOCC	California needlegrass
occidentalis	ACOCO	western needlegrass
Agrostis		
exarata	AGEX	spike bentgrass, redtop
scabra	AGSC5	ticklegrass, rough bentgrass
stolonifera	AGST2	creeping bentgrass
thurberiana	AGTH2	Thurber's bentgrass
Alopecurus		
aequalis	ALAE	short-awn foxtail
Bromus		
anomalus	BRAN	nodding brome
carinatus	BRCA5	mountain brome, Calif. brome
tectorum	BRTE	cheatgrass
Calamagrostis		
canadensis	CACA4	bluejoint reedgrass
purpurascens	CAPU	purple reedgrass
Dactylis		
glomerata	DAGL	orchardgrass
Danthonia spp.	DANTH	oatgrass
Deschampsia		
cespitosa	DECE	tufted hairgrass
elongata	DEEL	slender hairgrass
Distichlis		
spicata	DISP	saltgrass
Elymus		
elymoides	ELEL5	bottlebrush squirreltail
glaucus	ELGL	blue wildrye
trachycaulus ssp.		
trachycaulus	ELTRT	slender wheatgrass
Festuca		
rubra	FERU2	red fescue, ravine fescue
Glyceria		
elata	GLEL	tall mannagrass
Hordeum		
brachyantherum	HOBR2	meadow barley
jubatum	HOJU	foxtail barley
Leymus		
cinereus	LECI4	basin wildrye
triticoides	LETR5	beardless wildrye, creeping wildrye
Melica		
bulbosa	MEBU	big oniongrass, bulbous oniongrass
harfordii	MEHA2	Harford's oniongrass

Code	Wet Meadow	Moist Meadow	Dry Meadow	Non-Meadow Moist	Non-Meadow Dry
ACLE9	L	L	M		
STNE3	L	M		M	
ACNED				M	
ACNE10			M		
ACOCC				M	
ACOCO		M	M		
AGEX	L	L			L
AGSC5	L		L	L	
AGST2	L	L	L	L	
AGTH2		L		L	
ALAE	L	L		L	
BRAN	L	L	M	M	M
BRCA5		M	M	M	
BRTE	L	L	L	L	
CACA4	H	H		H	
CAPU				H	
DAGL		L	L		L
DANTH		M	M		
DECE	H	H		H	H
DEEL	L	L		L	
DISP		L	M?		
ELEL5		L	L		L
ELGL		M	M	M	
ELTRT	M	H	H	H	
FERU2	M	M	M	M	
GLEL	H	H		H	
HOBR2	L	L	L	L	
HOJU				L	
LECI4			H		
LETR5	M	M	M	M	
MEBU		L	L		
MEHA2					L

Botanical Name	Code	Common Name
Muhlenbergia		
asperifolia	MUAS	scratchgrass, alkali muhly
filiformis	MUFI2	pull-up muhly
richardsonis	MURI	mat muhly
Phalaris		
arundinacea	PHAR3	reed canarygrass
Phleum		
alpinum	PHAL2	alpine timothy
pratense	PHPR3	timothy
Poa		
bulbosa	POBU	bulbous bluegrass
cusickii	POCU3	Cusick bluegrass
pratensis	POPR	Kentucky bluegrass
secunda ssp		
juncifolia	POSEJ	Nevada bluegrass
secunda ssp.		
secunda	POSES	Sandberg's bluegrass
wheeleri	POWH2	Wheeler bluegrass
Polypogon		
monspeliensis	POMO5	rabbit'sfootgrass
Ptilagrostis		
kingii	PTKI	Sierran false needlegrass
Trisetum		
spicatum	TRSP2	spike trisetum
Sedges and Rushes		
Carex		
athrostachya	CAAT3	slenderbeak sedge, long-bracted s.
aurea	CAAU3	golden sedge
douglasii	CADO2	Douglas sedge
filifolia	CAFI	threadleaf sedge
heteroneura	CAHE8	different-nerve sedge
lanuginosa	CALA30	wooly sedge
microptera	CAMI7	smallwinged sedge
nebrascensis	CANE2	Nebraska sedge
nervina	CANE5	nerved sedge
pachystachya	CAPA14	thickhead sedge
praegracilis	CAPR5	Clustered sedge
preslii	CAPR8	Presl's sedge
rossii	CARO5	Ross' sedge
scopulorum	CASC12	mountain sedge
simulata	CASI2	shortbeak sedge
subfusca	CASU6	brown sedge
subnigricans	CASU7	black sedge
utriculata	CAUT	beaked sedge
vesicaria	CAVE6	inflated sedge

Code	Wet Meadow	Moist Meadow	Dry Meadow	Non-Meadow Moist	Non-Meadow Dry
MUAS		L	L	L	
MUFI2	M	M	M	M	
MURI	M	M	M	M	
PHAR3	L	L			
PHAL2	H	H		H	
PHPR3	L	L			
POBU		L	L		
POCU3	H	H	H	H	
POPR	M	M	H	M	M
POSEJ	H	H	H	H	
POSES		M	M		
POWH2			H	H	
POMO5			L	L	
PTKI				L	
TRSP2		H	H		
CAAT3	H	H		H	
CAAU3	H	H		H	
CADO2	L	L	M	M	
CAFI		M	H	M	
CAHE8	H	H	H	H	
CALA30	H	H		H	H
CAMI7	M	M	M	M	M
CANE2	H	H	H	H	
CANE5	H	H		H	
CAPA14			H	H	H
CAPR5	H	H	H		
CAPR8	X			L	
CARO5				H	
CASC12	H	H		H	
CASI2	H	H		H	
CASU6	H	H			
CASU7	H	H		H	
CAUT	H	H		H	
CAVE6	H	H		H	

Code	Wet Meadow	Moist Meadow	Dry Meadow	Non-Meadow Moist	Non-Meadow Dry
ELMA5	M				
ELPA4		H	M		
ELPA6	M	M		M	
JUBA	M	M	M	M	
JUBUO	L	L		L	
JUCOO	M		M	M	
JUEN	H	H			
JUME3	H	H			
JUNE	H	H		H	
JUOR	M	M		M	
JUSA			H	H	
LUCO6	H	H		H	
LUPA4	H	H			
LUSU7				H	
SCCO	H	M			
SCMI2	H	M		M	
TRCO4		H	H		
TYLA	H				
ACMI2	L	L	L	L	L
ACCO4	H	H	H	H	
AGGL	L	L	L		
ALBIB	L				M
ALLE3			M		
ALVA	H	H			
ANBR5		M	M	M	
ANDI2		L	L		
ANME2		H	H		
ANRO2	L	L	L	L	
AQFO	H	H	H	H	H
ARDR			L	L	

Botanical Name	Code	Common Name
Arnica		
chamissonis ssp.		
foliosa	ARCHF	chamisso arnica
mollis	ARMO4	wooly arnica
Artemisia		
ludoviciana	ARLU	Louisiana wormwood
Aster		
alpigenus var.		
andersonii	ASALA	alpine aster
ascendens	ASAS5	Chile aster
foliaceus	ASFO	leafy aster
occidentalis	ASOC	western mountain aster
Barbarea		
orthoceras	BAOR	wintercress
Caltha		
leptosepala var.		
biflora	CALEB3	marsh marigold
Camassia		
quamash	CAQU2	common quamash
Cardamine		
breweri	CABR6	Brewer's bittercress
Carduus		
Carduus spp.	CARDU	plumeless thistle
Castilleja		
applegatei	CAPA4	wavyleaf Indian paintbrush
miniata	CAMI12	scarlet paintbrush
Cerastium		
beeringianum var.		
capillare	CEBEC	Earl's chickweed
Chenopodium		
album	CHAL7	lamb's quarters
Cicuta		
douglasii	CIDO	Douglas' water hemlock, poison h.
Cirsium	CIRSI	thistle species
andersonii	CIAN	Anderson's thistle
arvense	CIAR4	Canada thistle, (NOXIOUS)
scariosum	CISC2	elk thistle
vulgare	CIVU	bull thistle
Claytonia		
lanceolata	CLLA2	lanceleaf spring beauty
perfoliata	CLPE	miner's lettuce
Collinsia		
parviflora	COPA3	blue-eyed Mary
torreyi	COTO	Torrey's blue-eyed Mary
Crepis		
acuminata	CRAC2	tapertip hawksbeard
Delphinium		
glaucum	DEGL3	mountain larkspur

Code	Wet Meadow	Moist Meadow	Dry Meadow	Non-Meadow Moist	Non-Meadow Dry
ARCHF	L	L	L	L	
ARMO4		M		M	
ARLU		L	L	L	
ASALA	L	L	L	L	
ASAS5				L	
ASFO	L	L	L	L	
ASOC	L	L	L	L	
BAOR					L
CALEB3	H	H			
CAQU2	H	H			
CABR6	L	L	L		
CARDU		L	L		
CASTI					
CAPA4		M	M		
CAMI12		M	M	M	
CEBEC		L	L		
CHAL7		L	L		
CIDO	M	M		M	
CIRSI				L	
CIAN		L	L		
CIAR4		L	L		
CISC2		M	M	M	M
CIVU		L	L		
CLLA2		L	M		
CLPE		L	L		
COPA3	L	L	L	L	
COTO		L			
CRAC2		L	L		L
DEGL3	H	H			

Botanical Name	Code	Common Name
Descurainia		
californicum	DECA6	Sierra tansymustard
pinnata	DEPI	pinnate tansy mustard
sophia	DESO2	flixweed tansymustard
Dodecatheon		
alpinum	DOAL	alpine shooting star
jeffreyi	DOJE	Jeffrey's shooting star
Dugaldia		
hoopsii	DUHO	orange sneezeweed
Epilobium		
angustifolium ssp.		
circumvagum	EPANC	fireweed
brachycarpum	EPBR3	autumn willowweed
ciliatum	EPCI	hairy willowweed
oreganum	EPOR2	Oregon willowweed
Equisetum		
arvense	EQAR	field horsetail
Erigeron		
coulteri	ERCO6	whiteray daisy
peregrinus	ERPE3	wandering daisy
Erodium		
cicutarium	ERCI6	cut-leaf filaree
Fragaria		
virginiana	FRVI	Virginia strawberry
Galium		
Galium spp.	GALIU	bedstraw
Gayophytum		
diffusum	GADI2	bigflower groundsmoke
racemosum	GARA	blackfoot gayophytum
ramosissimum	GARA2	pinyon smokeweed
Gentiana		
calycosa	GECA	mountain bog gentian
newberryi	GENE	alpine gentian
Gentianella		
Gentianella spp.	GENTI2	felwort, dwarf gentian
Gentionopsis		oneflower gentian,
simplex	GESI3	hiker's gentian, fringed g.
Geranium		
viscosissimum	GEVI2	sticky geranium
Geum		
macrophyllum	GEMA4	large-leaved avens
triflorum	GETR	prairiesmoke, old man's whisker's
Gnaphalium		
palustre	GNPA	marsh everlasting, marsh cudweed
Hackelia		
floribunda	HAFL2	showy stickseed, many-flowered s.
Heracleum		
lanatum	HELA4	cow parsnip
Hesperochiron		
californicus	HECA7	California hesperochiron

Code	Wet Meadow	Moist Meadow	Dry Meadow	Non-Meadow Moist	Non-Meadow Dry
DECA6					L
DEPI		H	H		
DESO2		H	H	H	
DOAL	H	H			
DOJE	M	M			
DUHO	L	L	L	L	
EPANC		L	L		
EPBR3		L	L		
EPCI	M	M	M	M	
EPOR2		M	L		
EQAR	L	L		L	
ERCO6	M	M			
ERPE3	M	M		M	
ERCI6		L	L		
FRVI		L	L		
GALIU	M	M	M	M	M
GADI2		L	L	L	
GARA		L	L		
GARA2	L	L	L		
GECA	M	M			
GENE	M	M		M	
GENTI2	M	M			
GESI3	M	M		M	
GEVI2		M	M		
GEMA4	L	M		M	M
GETR	L	M			
GNPA		L	L		
HAFL2		L	L		L
HELA4	H	H	H	H	
HECA7		L	L		

Botanical Name	Code	Common Name
Horkelia fusca ssp. parviflora	HOFUP2	smallflower horkelia
Hydrophyllum capitatum var. alpinum	HYCAA	alpine waterleaf
Hypericum anagalloides	HYAN2	tinker's penny
formosum var. scouleri	HYFOS	southwestern St. John's wort
Iris missouriensis	IRMI	wildiris, western blueflag
Ivesia aperta var. aperta	IVAPA	Sierra valley mousetail, RARE
sericoleuca	IVSE	Plumas ivesia
Lactuca serriola	LASE	prickly lettuce
Lappula redowski	LARE	desert stickseed
Ligusticum grayi	LIGR	Gray's licoriceroot, Gray's lovage
Lilium spp.	LILIU	lily
Linanthus harknessii	LIHA	threeseed linanthus
Linum lewisii	LILE3	Lewis' flax, blue flax
Lithophragma parviflorum var. parviflorum	LIPAP3	smallflower woodland star
Lotus purshianus	LOPU3	Spanish lotus
Lupinus argenteus	LUAR3	silvery lupine
lepidus var. sellulus	LULES	Sierra lupine, Donner Lake lupine
polyphyllus	LUPO2	bigleaf lupine, marsh lupine
Madia bolanderi	MABO	Bolander's madia
Medicago lupulina	MELU	black medick
Melilotus alba	MEAL12	white sweetclover
Mentha arvensis	MEAR4	wild mint
Mertensia ciliata	MECI3	streamside bluebells
Mimulus guttatus	MIGU	seep monkey flower
primuloides	MIPR	primrose monkey flower
Monardella odoratissima ssp. pallida	MOODP	alpine mtn. balm, pennyroyal

Code	Wet Meadow	Moist Meadow	Dry Meadow	Non-Meadow Moist	Non-Meadow Dry
HOFUP2		L	L	M	
HYCAA	M	M			
HYAN2	M	M			
HYFOS	M	M			
IRMI	L	L	L	L	
IVAPA		M	M		
IVSE		M	M		
LASE			L		
LARE		L	L		
LIGR		M	M	M	
LILIU	H	H		H	
LIHA		L			
LILE3		L	L		
LIPAP3			M		
LOPU3		L	L	L	
LUAR3			M		
LULES			M	M	
LUPO2	M	M		M	
MABO		L	L		
MELU		L	L		
MEAL12				L	
MEAR4				M	
MECI3	M	M	M		
MIGU	M	M		M	
MIPR	M	M		M	
MOODP					M

Botanical Name	Code	Common Name
Montia		
chamissoi	MOCH	water miner's lettuce, toadlily
linearis	MOLI4	narrowleaf miner's lettuce
Navarretia		
brewerii	NABR	Brewer's navarretia, yellow n.
Osmorhiza		
chilensis	OSCH	mountain sweetroot, sweet-cicely
occidentalis	OSOC	western sweetroot, sweetanise
Pedicularis		
attolens	PEAT	little elephant's heads
goenlandica	PEGR2	elephanthead lousewort
Penstemon		
heterodoxus	PEHE2	Sierra beardtongue
rydbergii var. oreocharis	PERYO	herbaceous penstemon
Perideridia		
bolanderi ssp. bolanderi	PEBOB	Bolander's yampah
lemmoni	PELE5	Lemmon's yampah
parishii	PEPA21	Parish's yampah, Queen Ann's lace
Plagiobothrys		
Plagiobothrys spp.	PLAGI	popcorn flower
Plantago		
major	PLMA2	broadleaf plantain, common p.
Platanthera		
hyperborea	PLHY2	northern green orchid
leucostachys	PLLE5	bog orchid
Polemonium		
occidentale	POOC2	western Jacob's ladder
Polygonum		
bistortoides	POBI6	American bistort
douglasii	PODO4	Douglas knotweed
polygaloides	POPO4	polygala knotweed
Potentilla		
anserina	POAN5	silverweed cinquefoil
biennis	POBI7	biennial cinquefoil
flabellifolia	POFL3	high mountain cinquefoil
glandulosa	POGL9	sticky cinquefoil
gracilis	POGR9	northwest cinquefoil, slender c.
Pseudostellaria		
jamesiana	PSJA2	Tuber starwort
Ranunculus		
alismifolius	RAAL	plantainleaf buttercup, dwarf b.
aquatilis	RAAQ	water buttercup, whitewater crowft.
cymbalaria var. saximontanus	RACYS	Rocky Mtn. buttercup
Rorripa		
curvisilique	ROCU	curvepod yellowcress
nasturtium-aquaticum	RONA2	watercress

Code	Wet Meadow	Moist Meadow	Dry Meadow	Non-Meadow Moist	Non-Meadow Dry
MOCH MOLI4	**M**	**M** **M**		**M**	
NABR			**L**		
OSCH OSOC		H H	H H	**H**	**H**
PEAT PEGR2	M M	M M			
PEHE2 PERYO	M **M**	M **M**	M **M**	**M**	
PEBOB PELE5 PEPA21		M **M** **M**	M	**M** **M**	
PLAGI	L	L	**L**		
PLMA2				**L**	
PLHY2 PLLE5	H H	H H			
POOC2	**L**			**M**	
POBI6 PODO4 POPO4	**M** **L** L	**M** **L** **L**	M **L** **L**	**M** **L** **L**	
POAN5 POBI7 POFL3 POGL9 POGR9	L M L **L**	L M L **L**	L L **L**	 **L** **L** **L**	
PSJA2	M	M	L		M
RAAL RAAQ RACYS	**L** M L	**L** M L	L		
ROCU RONA2	L L	**L**			

Botanical Name	Code	Common Name
Rumex		
acetosella	RUAC3	sheep sorrel
crispus	RUCR	curly dock
Sagina		
saginoides	SASA	arctic pearlwort
Saxifraga		
oregana	SAOR2	box saxifrage, Oregon saxifrage
Senecio		
hydrophyllus	SEHY2	water groundsel, alkali marshg.
serra var. serra	SESES	tall ragwort
triangularis	SETR	arrowleaf groundsel
Sidalcea		
oregana	SIOR	Oregon checkermallow
Sisyrinchium		
Sysyrinchium spp.	SISYR	blue-eyed grass
Smilacina		
racemosa	SMRA	feathery false Solomon's seal
stellata	SMST	starry false Solomon's seal
Solanum		
triflorum	SOTR	cutleaf nightshade
Solidago		
canadensis	SOCA6	Canada goldenrod
spectabilis	SOSP3	Nevada goldenrod, showy goldenr.
Sphenosciadium		
capitellatum	SPCA5	woolyhead parsley, button parsley
Spiranthes		
romanzoffiana	SPRO	hooded ladies tresses
Stellaria		
longipes var. longipes	STLOL3	long-stalked starwort
Taraxacum		
offficinale	TAOF	common dandelion
Thalictrum		
sparsiflorum	THSP	fewflower meadowrue
Tragopogon		
dubius	TRDU	yellow salsify
Trifolium	TRIFO	clover species
longipes	TRLO	long-stalked clover
monanthum	TRMO2	carpet clover
oliganthum	TROL	fewflower clover
repens*	TRRE3	white clover
wormskioldii	TRWO	cow's clover, Sierra clover
Urtica		
dioica	URDI	stinging nettle
Veratrum		
californicum var. californicum	VECAC2	California false hellebore
Verbascum		
thapsis	VETH	common mullein

Code	Wet Meadow	Moist Meadow	Dry Meadow	Non-Meadow Moist	Non-Meadow Dry
RUAC3	L	L			
RUCR	L	L			
SASA	L	L			
SAOR2	M	M		M	
SEHY2	M	M			
SESES	L	L			
SETR				L	
SIOR	L	L	L	L	
SISYR	M	M	M		
SMRA	M	H	H		
SMST	M	H	H	H	
SOTR	L				
SOCA6	L	L	L	L	
SOSP3				L	
SPCA5	H	H	H	H	H
SPRO	H	H		H	
STLOL3	M	H	L	H	
TAOF	L	L	L	L	
THSP				M	
TRDU			L		
TRIFO					M
TRLO	M	M	L	M	M
TRMO2	M	M	L	M	
TROL	M	M			
TRRE3	L	L	L	L	
TRWO	M	M	L	M	
URDI	L	L	L	L	
VECAC2	M	M	M	M	
VETH				L	

Botanical Name	Code	Common Name
Veronica		
Veronica spp.	VERON	speedwell
Vicia		
americana	VIAM	American vetch
Viola		
adunca	VIAD	western dog violet, hooked spur v.
macloskeyi	VIMA2	Macloskey's violet
sororia ssp.affinis	VISOA	sand violet, LeConte violet
Zigadenus		
venenosus var.		
venenosus	ZIVEV	meadow death camas
Shrubs and Trees		
Abies		
concolor	ABCO	white fir
Alnus		
incana ssp.		
tenuifolia	ALINT	thinleaf, mountain alder
Amelanchier		
alnifolia	AMAL2	western serviceberry
Artemisia		
cana	ARCA13	silver sagebrush
tridentata ssp.		
tridentata	ARTRT	basin big sagebrush
tridentata ssp.		
vaseyana	ARTRV	mountain big sagebrush
Chrysothamnus		
nauseosus	CHNA2	rubber rabbitbrush
Cornus		
sericea	COSE16	redosier dogwood, western d.
Lonicera		
involucrata	LOIN5	twin berry
Phyllodoce		
breweri	PHBR4	purple mountain heather
Pinus		
contorta ssp.		
murrayana	PICOM4	Murray lodgepole pine
jeffreyii	PIJE	Jeffrey pine
Populus		
balsamifera ssp.		
trichocarpa	POBAT	black cottonwood
tremuloides	POTR5	quaking aspen
Potentilla		
fruticosa	POFR4	shrubby cinquefoil
Prunus		
emarginata	PREM	bitter cherry
virginiana var.		
demissa	PRVID	western chokecherry

Code	Wet Meadow	Moist Meadow	Dry Meadow	Non-Meadow Moist	Non-Meadow Dry
VERON	M	M		M	M
VIAM	L	L	L	L	L
VIAD	M	M	M	M	
VIMA2	M	M	M		
VISOA	M			M	M
ZIVEV		M	M		
ABCO				H	H
ALINT				H	H
AMAL2				H	H
ARCA13	L	L	H	H	
ARTRT		L	L	H	H
ARTRV					H
CHNA2		L	L	L	
COSE16				H	H
LOIN5				H	
PHBR4		H	H	H	
PICOM4				H	
PIJE					H
POBAT			H	H	
POTR5				H	H
POFR4		H	H	M	
PREM					
PRVID			M	M	

Botanical Name	Code	Common Name
Ribes		
aureum	RIAU	golden current
cereum	RICE	wax current
inerme	RIIN2	white-stem gooseberry
montigenum	RIMO2	mountain gooseberry
nevadense	RINE	mountain pink current, Sierran c.
Rosa		
woodsii var. ultramontana	ROWOU	Wood's rose
Salix		
boothii	SABO2	Booth's willow
eastwoodiae	SAEA	Eastwood's willow
exigua	SAEX	coyote willow
geyeriana	SAGE2	Geyer's willow
jepsonii	SAJE	Jepson willow
lasiolepis	SALA6	arroyo willow
lemmonii	SALE	Lemmon's willow
lucida ssp. lasiandra	SALUL	Pacific willow
lutea	SALU2	yellow willow
planifolia	SAPL2	planeleaf willow
orestera	SAOR	Sierra willow
scouleriana	SASC	Scouler willow
Sheperdia		
argentea	SHAR	silver buffalo berry
Symphoricarpos		
rotundifolius	SYRO	roundleaf snow berry
Vaccinium		
caespitosum	VACE	dwarf bilberry, dwarf blueberry
uliginosum	VAUL	western bog blueberry

Code	Wet Meadow	Moist Meadow	Dry Meadow	Non-Meadow Moist	Non-Meadow Dry
RIAU				M	
RICE			M	**M**	**M**
RIIN2				**H**	**H**
RIMO2				H	
RINE				H	
ROWOU		M	M	**M**	**M**
SABO2	H	H	H	**H**	**H**
SAEA	H	H	H	**H**	H
SAEX	H	H	H	**H**	H
SAGE2	**H**	**H**	H	**H**	H
SAJE	H	H	H	H	H
SALA6	H	H	H	H	H
SALE	H	H	H	**H**	H
SALUL	H	H	H	**H**	H
SALU2	H	H	H	**H**	H
SAPL2	H	H	H	**H**	H
SAOR	H	H	H	**H**	H
SASC	H	H	H	H	**H**
SHAR	L	L	L	**M**	
SYRO				**H**	**H**
VACE		H	H	**H**	
VAUL		H	H	H	

☆ U.S. GOVERNMENT PRINTING OFFICE: 1999 — 775-773 / M7560 Region No. 8